

Fall 11-25-2014

Executive Functioning in the Context of Urban Poverty: An Examination of Poverty Related Stress and Its Relationships to Academic Achievement

Jacquelyn L. Doxie
DePaul University, jdoxie@depaul.edu

Follow this and additional works at: https://via.library.depaul.edu/csh_etd



Part of the [Clinical Psychology Commons](#)

Recommended Citation

Doxie, Jacquelyn L., "Executive Functioning in the Context of Urban Poverty: An Examination of Poverty Related Stress and Its Relationships to Academic Achievement" (2014). *College of Science and Health Theses and Dissertations*. 96.

https://via.library.depaul.edu/csh_etd/96

This Dissertation is brought to you for free and open access by the College of Science and Health at Digital Commons@DePaul. It has been accepted for inclusion in College of Science and Health Theses and Dissertations by an authorized administrator of Digital Commons@DePaul. For more information, please contact digitalservices@depaul.edu.

Executive Functioning in the Context of Urban Poverty: An Examination of Poverty-Related Stress and
Its Relationship to Academic Achievement in Urban Youth

A Dissertation
Presented in
Partial Fulfillment of the
Requirements for the Degree of
Doctor of Philosophy

By
Jacquelyn L. Doxie
August 2014

Department of Psychology
College of Science and Health
DePaul University
Chicago, Illinois

Dissertation Committee

Kathryn Grant, Ph.D., Chairperson

Bernadette Sanchez, Ph.D

Jocelyn S. Carter, Ph.D.

Gayle Mindes, Ed.D.

Patrice Bounds, Ph.D.

Acknowledgments

I would like to express my sincere gratitude and appreciation to my dissertation chair, Dr. Kathryn Grant for her support and guidance throughout my graduate school career. I would also like to thank my dissertation committee, Dr. Bernadette Sanchez, Dr. Jocelyn Carter, Dr. Gayle Mindes, and Dr. Patrice Bounds for their willingness to be a part of this project and guidance they have provided. Lastly, I would like to thank Matthew King and Justin Bridges for their unconditional support and understanding as I complete my doctoral degree.

Biography

The author was born in Hattiesburg, Mississippi on December 16th, 1982. She graduated from Saint Joseph's High School in June of 2001, received her Bachelor of Arts Degree from Purdue University in 2005, and a Master of Arts degree from DePaul University in 2010. She completed her pre-doctoral internship in clinical psychology at Henry Ford Health System in June, 2014, where she received specialized training in pediatric neuropsychology.

Table of Contents

Dissertation Committee.....	ii
Acknowledgements.....	iii
Biography.....	iv
List of Tables.....	vii
List of Figures.....	viii
Abstract.....	1
Introduction.....	4
Poverty-Related Stress and Academic Achievement.....	5
Mechanisms in the Relationship between Poverty-Related Stress and Achievement.....	6
Executive Functioning	8
Executive Functioning and Academic Achievement.....	14
Executive Functioning and Poverty-Related Stress.....	15
Rationale.....	17
Statement of Hypotheses	18
Research Questions.....	19
Method.....	20
Research Participants.....	20
Procedure.....	22
Materials.....	22
Results.....	30
Preliminary Data.....	30
Primary Analyses	36
Discussion.....	47

References.....61

List of Tables

Table 1. Executive Function Definitions, Skills, and Measurements of Studies included in Literature Review.....	9
Table 2. Means and standard deviations for major life events/daily hassles, Executive Functioning Scores, and GPA separated by gender.....	31
Table 3. Correlations Among Predictor, Mediator, and Outcome Variables.....	35

List of Figures

Figure 1. Theoretical Model of Executive Functioning as a Mediator in the Relationship between Poverty-Related Stress and Academic Achievement.....	18
Figure 2. Time 1 Income Frequencies.....	21
Figure 3. Time 2 income Frequencies.....	21
Figure 4. Measurement Model of Latent Variable Poverty-Related Stress.....	38
Figure 5. Measurement Model of Latent Variable of Executive Functioning.....	39
Figure 6. Model Examining the Direct Effect of major life events/daily hassles on Executive Functioning.....	41
Figure 7. Model Examining the Direct Effect of Executive Functioning on GPA.....	42
Figure 8. Model Examining Executive Functioning as a Partial Mediator of Poverty Related Stress and GPA	43
Figure 9. Model Examining Executive Functioning as a Partial Mediator of major life events/daily hassles and GPA.....	44
Figure 10. Measurement Model of Latent Variable Laboratory Executive Skills.....	45
Figure 11. Model Examining Executive Functioning as a Partial Mediator of major life events/daily hassles and GPA.....	46

Abstract

Living in urban poverty has been linked to numerous negative conditions that disproportionately expose low-income urban youth and their families to severe and chronic stressors (Collins et al., 2010; DeNavas-Walt, Proctor, and Smith, 2012; Sznitman, Reisel, and Romer, 2011). Research has consistently shown a strong relationship between these stressors and numerous negative outcomes that can impact an adolescent emotionally, behaviorally, and academically (Conger et al., 2002). This dissertation is focused on the area of academic achievement, an outcome consistently found to be negatively impacted by poverty (Rouse and Fantuzzo, 2009). Based on Bronfenbrenner's model of bio-ecological human development (Bronfenbrenner and Morris, 1998; Bronfenbrenner and Evans, 2000) and a similar model by Perkins and Graham-Bermann (2012), executive functioning was hypothesized to mediate the relationship between poverty-related stress and academic achievement. Measurement models of poverty-related stress and executive functioning were further hypothesized to have adequate fit with the current sample data.

Given the two time-point design of the study, recommendations for analysis of partial mediation by Cole and Maxwell (2003) were followed. Results revealed support for the measurement model of executive functioning, however the measurement model of poverty-related stress was not supported. Given the inadequate fit of the poverty-related stress latent variable with sample data, partial mediation analysis was conducted with the stress variable of major life events and daily hassles. Results of partial mediation analysis revealed support for the direct effect of major life events/daily hassles on executive functioning skills. However, as executive functioning did not have a significant direct effect on grade point average. Therefore, evidence of partial mediation was not supported in this study. In addition to primary study hypotheses, age and gender group differences were also examined. Findings indicate the

need for future research of specification in the relationship between stressors and executive functioning skills.

PART I. INTRODUCTION

According to the United States Census Bureau, over 46 million people live in poverty (DeNavas-Walt, Proctor, and Smith, 2012). Living in urban poverty has been linked to numerous negative conditions that disproportionately expose low-income urban youth and their families to severe and chronic stressors. These stressors often take the form of community stressors such as high crime rates, increased exposure to gang and drug activity, substandard housing, and neighborhood violence (Collins et al., 2010; Sznitman, Reisel, and Romer, 2011). As a result, youth and families often experience a myriad of related interpersonal stressors such as high rates of incarceration, family death and violence, and conflicts in couple, parent-child, and sibling relationships (Collins et al., 2010; Lambert, Bradshaw, Cammack, and Ialongo, 2011). Further, because there are often multiple generations of family members living in urban poverty, the stressors faced by youth can be compounded. Specifically, youth living in urban poverty can undergo intergenerational trauma in which the adults living in the environment transfer trauma to their children through problems with aggression, regulation of emotions, social competence, and interpersonal relationships (Collins et al., 2010). In addition to community, interpersonal, and family stressors, youth living in these environments often have limited access to healthcare and attend poorly funded, low-quality schools. Research has consistently shown a strong relationship between these stressors and numerous negative outcomes that can impact an adolescent emotionally, behaviorally, and academically (Conger et al., 2002; Grant et al., 2003; Rouse and Fantuzzo, 2009; Wadsworth and Berger, 2006).

This dissertation focused on the area of academic achievement, an outcome consistently demonstrated to be negatively affected by poverty (Rouse and Fantuzzo, 2009). Research has repeatedly shown a gap in achievement between low-income students and their higher income

counterparts (Sznitman, Reisel, and Romer, 2011; Rouse and Fantuzzo, 2009; Malecki and Demaray, 2006; Evans and Rosenbaum, 2008). This income-achievement gap has proved to have a major impact on the trajectory of low-income children and adolescents. Specifically, as deficits in academic skills become more pronounced overtime, and low-income children become more likely to drop out of school (Caro, McDonald, and Willms, 2009). Further, these children are found to be less likely to enroll in institutions of higher education, and less likely to obtain desirable jobs (Caro, McDonald, and Willms, 2009; DeNavas-Walt, Proctor, and Smith, 2012; Ou and Reynolds, 2008), thereby perpetuating a cycle of poverty. Although empirical evidence supports the relationships between poverty-related stressors and academic achievement in low-income urban youth, much less is known about how and why urban poverty leads to these outcomes.

In order to answer these questions, the following literature review examined poverty related environmental factors (including income and exposure to violence) and its impact on academic achievement. This review then examined past theory outlining mechanisms connecting stress and achievement, including executive functioning processes. Third, this review examined the varying definitions of executive functioning and measurement characteristics. Finally, this review examined literature which explored the role of the environment on executive functioning, as well as the relationships between executive functioning and academic achievement.

It should be noted that this literature review was limited to the past 15 years, with the exception of seminal works or in cases in which the article described the original versions of measures used in the current study. The literature review was also limited to studies using child and adolescent populations. Finally, literature on executive functioning focused on studies examining its relation to poverty and achievement and did not cover studies examining solely clinical samples.

Poverty-Related Stress and Academic Achievement

In studies of academic achievement, achievement is measured in a variety of ways, including standardized test scores, placement in advanced academic tracks, college placement, grade point average, and high test scores in academic subjects (i.e. mathematical computation) (Caro, McDonald, and Willms, 2009). As stated previously, there has been a long-standing academic achievement gap between low socioeconomic status (SES) and high SES students (Caro, McDonald, and Willms, 2009). In fact, researchers believe that the largest proportion of variance in academic achievement can be attributed to the socio-economic status of a student's family (Chen and Weikart, 2008). According to the American Psychological Association (2014), children from low-income families have fewer language skills when they start kindergarten and score ten percent lower in reading and math than their higher income counterparts (Purcell-Gates, McIntyre, and Freppon, 1995). In addition, since minority youth are disproportionately represented among youth living in urban poverty, the income-achievement gap also translates to gaps for black and Hispanic children compared to their white counterparts (DeNavas-Walt, Proctor, and Smith, 2012).

Research on the income-achievement gap between low and high SES youth has been conducted in samples ranging from preschool to college. For example, one study examined reading and math achievement as it relates to family income among early childhood and school-age populations. It was found that increased family poverty led to decreased reading and math achievement scores (Obradović et al., 2009). Not only has the income-achievement gap been found to affect youth of all ages, extant research suggests the gap widens as age increases. In particular, Caro and colleagues found that the income achievement gap widened significantly across ages 7 to 15 when assessing mathematics scores through a standardized achievement test. Specifically, math achievement scores between low-income and high-income children age 12 to 15 were twice as large as the gap between low-income and high-

income children age 7-11 (Caro, McDonald, and Willms, 2009). Authors posit that these findings are consistent with the theory of cumulative advantage, in which “educational disparities associated with family background tend to increase as students advance in school” (Caro, McDonald, and Willms, 2009, p. 576).

In addition to low-income, other stressors related to urban poverty have been found to have negative effects on academic achievement. One such stressor is exposure to violence. Studies of early school age children examined exposure to violence and found that increased exposure was associated with decreased grades and test scores in math and reading (Delaney-Black et al., 2002; Milam, Furr-Holden, and Leaf, 2010). Exposure to violence in low-income urban environments has been found to predict a variety of cognitive and academic problems (DeNavas-Walt, Proctor, and Smith, 2012). For example, a study examining exposure to violence, trauma symptoms, and achievement in 110 inner-city African American middle school children found that there was a negative relationship between increased exposure to violence and scores on standardized tests (Thompson and Massat, 2005). For older adolescents, the effects for exposure to violence on achievement have been found to last even after they had left the low-income urban environment. For example, Wolniak and colleagues found that exposure to violence in high school was associated with the student’s low grade point average in college (Wolniak and Engberg, 2010). Although empirical evidence supports the relationships between poverty-related stressors and academic achievement in low-income urban youth, much less is known about how and why urban poverty leads to negative academic outcomes.

Mechanisms in the relationship between stress and achievement. The mechanisms thought to link impoverished environments with negative psychosocial outcomes have been laid out by ecologically based theories. The dominant ecological theory is Bronfenbrenner’s model of bio-ecological human development (Bronfenbrenner and Morris, 1998; Bronfenbrenner and Evans, 2000)

which posits humans develop through reciprocal interactions between themselves and the environment. These interactions occur on a regular basis over time and are known as proximal processes. These proximal processes lead to one of two outcomes: competence or dysfunction. Competence refers to an individual's ability to demonstrate an acquired ability, skill, or knowledge, which he/she can use across situations. Alternately, dysfunction refers to reoccurring difficulties in acquiring; maintaining; and integrating knowledge, skill, or abilities across situations (Bronfenbrenner and Morris, 1998). According to this theory, the more negative the environmental influences, the more likely a child will experience dysfunction. It follows that children who are chronically exposed to poverty, experience more frequent negative outcomes (Raver, Blair, Willoughby, and The Family Life Project Key Investigators, 2012).

While there have been several studies examining predictors of academic achievement in youth living in poverty (Irvin, Meece, Byun, Farmer, and Hutchins, 2011; Malecki and Demaray, 2006; Milne and Plourde, 2006; Ou and Reynolds, 2008), only three studies have explored proximal processes in the relationship between poverty and academic achievement. Processes examined included sleep problems (Brown and Low, 2008); adolescent emotional well-being (Sznitman, Reisel, and Romer, 2011); and executive functioning (Evans and Rosenbaum, 2008). In the study conducted by Evans and Rosenbaum (2008) the role of self-regulation in the relationship between income and academic achievement was examined in a sample of 97 rural 9-11 year olds. Results of this study found self-regulation (measured through delay of gratification) was a significant mediator of the relationship between income and decreased English and math grades. The sample of this study was made up of primarily Caucasian (95%) school-age sample. Therefore, it is important to build upon it with more diverse samples given that previous research has shown that the achievement gap particularly affects minority youth who are disproportionately represented among the poor (DeNavas-Walt, Proctor, and Smith, 2012). In addition,

the study by Evans and Rosenbaum is also limited in the exploration of self-regulation as a mediator, as it is only a small component of neurological processes known as executive functioning. Emerging research suggests that a variety of compromised executive functioning abilities may serve as mechanisms that mediate the relationship between urban poverty and low academic achievement in low income urban youth.

Executive Functioning

Executive functioning (EF) is an umbrella term describing complex cognitive processes which bring about ongoing, goal-directed behavior (Meltzer, 2007). Executive functioning has also been defined as a “collection of processes that are responsible for guiding, directing, and managing cognitive behavioral functions, particularly during active, novel problem solving” (Gioia, Isquith, Guy, and Kentworthy, 2000, page 1). Further, some researchers define executive functioning in terms of deficits that result when skills are not adequately developed. These can include perseverations, impulsive behavior, lack of initiative, disregard for safety, or inflexibility (Egeland and Fallmyr, 2010). Given the lack of consensus in executive functioning, there are a wide variety of ways in which researchers examine the construct. Table 1 outlines definitions and constructs used to measure executive functioning based on studies included in this review.

Table 1. Executive Function Definitions, Skills, and Measurements of Studies included in Literature Review

<u>Authors</u>	<u>Definition of Executive Functioning</u>	<u>Executive Functioning Skills Assessed</u>	<u>Measurement Used</u>
Blair, Willoughby, Greenberg, Kivlighan, Fortunato, et.al. (2011)	"...Cognitive abilities associated with prefrontal cortex (PFC), including working memory, inhibitory control, and attention shifting or flexibility, that enable the organization of information in goal-directed activities."	Working memory, attention shifting, inhibitory control	<u>Span-like working memory task</u> , <u>Flexible Item Selection Task</u> (Jacques and Zelazo, 2001) <u>Spatial Conflict inhibitory control task</u> (similar to that used by Diamond et al., 2007)
Latzman, Elkovitch, Young, and Lee (2010)	Executive functioning (EF) constitutes abilities related to higher order cognitive processes that encompass a number of subdomains including judgment, decision making, and coordinating/sequencing cognitive operations and social conduct.	Attention, concentration, cognitive flexibility, verbal fluency, shift, inhibition conceptual flexibility, planning	<u>Delis-Kaplan Executive Functions System</u> (D-KEFS; Delis et al., 2001)
Bierderman, Monuteaux, Doyle, Seidman, Wilens, Ferrero, et al. (2004)	"The ability to maintain an appropriate problem set for attainment of future goals"	Planning and organization, auditory sustained attention, vigilance, and impulsivity, cognitive flexibility, verbal learning and working memory, response inhibition	<u>Rey-Osterrieth Complex Figure</u> (Osterrieth, 1944; Rey, 1941), <u>Auditory Continuous Performance Test</u> (Weintraub and Mesulam, 1985), <u>Wisconsin Card Sorting Test</u> (WCST; Heaton, Chelune, Talley, Kay, and Curtiss, 1993), <u>Wide Range Achievement of Memory and Learning test</u> (Adams and Sheslow, 1990), <u>California Verbal Learning Test</u> (Delis, Kramer, Kaplan, and Ober, 1987), <u>Stroop test</u> (Golden, 1978), <u>Freedom from Distractibility Index</u> (Wechsler, 1974, 1981)
Carlson and Wang (2007)	"..conscious control of thought and action needed for future-oriented and purposeful behavior."	Inhibition	<u>Forbidden Toy task</u> (modeled after Lewis, Stanger, and Sullivan's (1989), <u>Gift Delay task</u> (adapted from Kochanska et al., 2000), <u>Simon Says</u> (Strommen, 1973)
Simonds, Kieras, Rueda, and Rothbart (2007)	Not defined	Executive attention, effortful control (inhibition), and self - regulation	<u>Attention Network Test (ANT) for Children</u> (Rueda et al., 2004), <u>Mistaken gift paradigm</u>

Bernier, Carlson, Deschenes, and Matte-Gagne (2012)	“A set of higher-order cognitive processes such as impulse control, set shifting, planning and working memory, that take a managerial role in the monitoring of goal-directed action and self-regulated responses to novel or ambiguous situations (Garon, Bryson and Smith, 2008; Hughes, Graham and Grayson, 2004).”	Working memory, inhibitory control, and set-shifting	<u>Spin the Pots</u> (Hughes and Ensor, 2005). <u>Shape Stroop</u> (Kochanska et al., 2000). <u>Baby Stroop</u> (adapted from Hughes and Ensor, 2005). <u>Bear/ Dragon</u> (Reed, Pien and Rothbart, 1984) <u>Day/Night</u> (Gerstad, Hong and Diamond, 1994) <u>Dimensional Change Card Sort</u> (DCCS; Zelazo, 2006) <u>Delay of gratification</u> (Kochanska et al., 2000)
Schroeder and Kelley (2010)	“A set of higher order thought processes used daily for the coordination of planning, execution of thoughts, behaviors and emotions, and storage of Information in working memory”	Working memory, planning/organization, organization of materials, task monitor, emotional control, self-monitoring, metacognition, emotional regulation, and behavior regulation.	<u>BRIEF – Parent Form</u> (Gioia, Isquith, Guy, and Kenworthy, 2000)
Porter and Leach (2010)	“Capacity to co-ordinate simultaneous activities, to switch attention from one activity to another, to attend selectively to one activity whilst suppressing the processing of irrelevant stimuli, and the capacity to encode (learn), access, retrieve and manipulate information in long-term memory.”	Divided attention, memory span, verbal fluency, flexibility, inhibition, memory, and problem solving	<u>Dual task test</u> (Baddeley et al., 1997), <u>Stroop test</u> (1935), <u>Verbal fluency</u> , <u>Random letter generation task</u> (Baddeley, 1966, 1991) <u>The Tower of London task</u> (Shallice, 1982)
Schroeder and Kelley (2009)	“A set of regulatory processes necessary for selecting, initiating, implementing, and overseeing thought, emotion, behavior, and certain facets of motor and sensory functions	Working memory, planning/organization, organization of materials, task monitor, emotional control, self-monitoring, metacognition, emotional regulation, and behavior regulation.	<u>BRIEF – Parent Form</u> (Gioia, Isquith, Guy, and Kenworthy, 2000),
Fishbein, Warner, Krebs, Trevarthen, Flannery and Hammond (2009)	Neurocognitive functions- “Executive cognitive and emotional regulatory mechanisms modulated by the corticolimbic circuitry”	Memory, problem solving (planning, execution, monitoring), working memory, and inhibition	<u>The Logan Stop-Change Task</u> (Logan and Burkell, 1986). <u>The Stroop Color Word Test</u> (Golden, 1978). <u>The Tower of London</u> (Culbertson and Zilmer, 2001)
Egeland and Fallmyr (2010)	“Supervisory functions modifying the output of some other cognitive process”	Working memory, planning/organization, organization of materials, task monitor,	<u>BRIEF – Parent Form</u> (Gioia, Isquith, Guy, and Kenworthy, 2000),

		emotional control, self-monitoring, metacognition, emotional regulation, and behavior regulation.	
Riccio, Hewitt, and Blake (2011)	At the most global level, executive function is composed of those composite psychological processes necessary for problem solving (Zelazo, Carter, Reznick, and Frye, 1997) and self-regulation (Barkley, 2000).	Metacognition, behavioral self-regulation, reaction time, set shifting, verbal fluency, inhibition, and working memory	<u>Wisconsin Card-Sorting Test</u> (WCST; Heaton, Chelune, Talley, Kay, and Curtiss, 1993). <u>Tower of London–Drexel Edition</u> (TOLDX; Culbertson and Zillmer, 2000). <u>Verbal fluency</u> (Denckla, 1996). <u>The Behavior-Rating Inventory of Executive Function</u> (BRIEF; Gioia, Isquith, Guy, and Kenworthy, 2000).
Aupperle, Melrose, Stein, and Paulus (2012)	“The control of complex goal-directed behavior (Royall et al., 2002; Alvarez and Emory, 2006; McCabe et al., 2010).”	Attention, working memory, sustained attention, flexibility, switching, inhibitory function, and planning.	N/A- Review
DePrince, Weinzierla, and Combs (2009)	“Executive functions (EFs) are comprised of such diverse abilities as directing attention (including shifting, inhibiting, and focusing attention), manipulating information in working memory, and self-monitoring.”	Working memory, inhibition, processing speed, interference control, and auditory attention.	<u>Wechsler Intelligence Scale for Children-Fourth Edition</u> (WISC-IV; Wechsler, 2003), <u>Gordon Diagnostic System</u> (GDS; Gordon and Barkley, 1998), <u>Brief Test of Attention</u> (BTA; Schretlen, Bobholz, and Brandt, 1996), <u>Stroop Task</u> .
Polak, Witteveen, Reitsma, and Olf (2012)	Divided attention, cognitive flexibility, selective attention and inhibition, working memory and planning	Divided attention, cognitive flexibility, selective attention, inhibition, working memory, planning	<u>Trail Making Test</u> (TMT; Reitan, 1992) <u>Wisconsin Card Sorting Test</u> (WCST; Heaton, 1981), <u>WAIS-R Digit Span</u> (Wechsler, 1981) or <u>WAIS- III Digit Span</u> (Wechsler, 1997) <u>Stroop</u> (Stroop, 1935), <u>Rey-Osterrieth Complex Figure Test</u> (RCFT; Rey, 1941)
Walter, Palmieri, and Gunstad (2010)	“Set of cognitive processes such as reasoning and decision-making, regulation of impulsive behavior, and mood stability”	Inhibition, set-shifting, and cognitive flexibility.	<u>Rey-O Complex Figure task</u> (RCFT; Rey, 1941), <u>Delis-Kaplan Executive Function System: Trail Making Test Condition 4 Letter-Number Sequencing</u> (Delis, Kaplan, and Kramer, 2001) <u>The Stroop Color and Word Test</u>

Mazzocco and Kover (2007)	“Among the more frequently articulated executive function constructs are those reflecting inhibition of prepotent responses, working memory — the ability to maintain information online, reactive flexibility or switching between response sets, and response fluency.”	Response inhibition, cognitive flexibility	<u>The Contingency Naming Test</u> (CNT; Anderson, Anderson, Northam, and Taylor, 2000; Taylor, Albo, Phebus, Sachs, and Bierl, 1987).
Best, Miller, and Naglieri (2011)	Adaptive, goal- directed behavior	Planning, monitor, and task completion	<u>Cognitive assessment system</u> (CAS; Naglieri and Das, 1997).
Brocka, Rimm-Kaufmana, Nathansona, Grimm (2009)	EF refers generally to the coordination of higher order thought processes (including inhibitory control, working memory, and attention)	Problem-solving, emotional restraint, and self-control	A live-coding battery, adapted from the <u>Preschool Self-Regulation Assessment</u> —PSRA (Cameron and Morrison, 2007; Smith- Donald et al., 2007)
Raver, Blair, and Willoughby (2012)	Not defined	Working memory, attentional set shifting, and inhibitory control	<u>Working memory span task</u> (modeled on the flexible item selection task-Jacques and Zelazo, 2001). <u>The spatial conflict arrows task</u> (Simon task similar to that used by Gerardi-Caulton, 2000)
Sarsour, Sheridan, Jutte, Nuru-Jeter, Hinshaw, Boyce (2011)	Executive functions consists of following core competencies: working memory, the ability to hold and manipulate complex information in your mind (Baddley, 1998; Smith and Jonides, 1997); inhibition (or inhibitory control), the ability to delay a well learned prepotent responses for the purposes of a more appropriate response (Barkley, 2001); and cognitive flexibility, the capacity to adapt behavior quickly and flexibly to changing situations (Davidson, Amso, Anderson, and Diamond, 2006; Diamond, 2006)	Working memory, inhibition, and cognitive flexibility	<u>The Digit span subtest from the Wechsler Intelligence Scale for Children</u> (Wechsler, 1994) <u>The Trail Making Test</u> (Trails A and B; Korte, Horner, and Windham, 2002). <u>The Stroop Test</u> (Golden, 1978; MacLeod, 1991).

Given the lack of consensus of the executive functioning construct, Gioia and colleagues identified eight skills of executive functioning through confirmatory factor analysis (Egeland and Fallmyr, 2010). These eight skills fall into two subtypes: metacognition and behavioral regulation. Metacognition, is the ability of a person to use planning, organizational, and initiating skills to solve a future oriented problem while monitoring his/her performance on the task. Metacognition skills include: goal setting and planning; organization of behaviors over time; cognitive flexibility; working memory; problem solving; decision making; self-directed goal selection; monitoring; and attention. The second subtype, behavioral regulation, encompasses inhibition, shifting of thoughts and behaviors, and emotional control. This aspect of executive functioning also includes self-regulatory processes, which work to regulate behavior by using past knowledge, experiences, and current situational cues (Bernier, Carlson, and Whipple, 2010; Meltzer, 2007; Moran and Gardner, 2007; Sergeant, Geurts, and Oosterlaan, 2002; Zera and Lucian, 2001). It is hypothesized that a child needs to have adequate behavior regulation in order to fully use and engage in his or her metacognitive skills (Gioia, Isquith, Guy, and Kentworthy, 2000).

These executive functioning processes have emerged as hypothesized mechanisms in the relationship between poverty-related stressors and academic achievement due to, 1) impact they have on academic achievement and 2) their vulnerability to environmental influences. Perkins and Graham-Bermann (2012) further specify the executive functioning skill of self-regulation as a mechanism that explains the relationships between violence exposure and the development of academic and mental health problems in children. Their model posits that early life stressors have an adverse affect on the executive functioning skill of self-regulation through interactions between an individual's biological/brain mechanisms and the environment. In turn, the self-

regulation deficits caused by life stressors bring about negative mental health and academic outcomes in the child. In this mediation model, proximal processes take the form of the interactions between the individual's biological/brain mechanisms and the environment while the resulting dysfunction is in the form of the executive functioning processes. In the same way the executive functioning skill of self-regulation was hypothesized as a mediator between life stressors and outcomes, other executive skills may serve as mediators in the relationship between poverty-related stress and academic achievement. Emerging empirical support of executive functioning as a possible mediator between poverty-related stress and achievement can be found in prior research.

Executive Functioning and Academic Achievement. Executive functioning processes have been shown to predict academic achievement in youth, especially during middle childhood and adolescence (Blair et al., 2011). For example, Latzman and colleagues (2010) examined relationships among three executive functions (conceptual flexibility, monitoring, and inhibition) and standardized test scores in a sample of 11 to 16 year-old males. Conceptual flexibility was significantly linked to future reading and science achievement scores; monitoring was significantly linked to reading and social studies achievement scores; and inhibition was significantly linked to math and science achievement scores. Further, elements of executive functioning processes (inhibition, attention, and self-regulation) have also been linked to communication and social skills; as well as emotional regulation skills. Some studies postulate that the impact of inhibition, attention, or self-regulation deficits on these processes such as communication and emotional regulation can hinder a child's ability to perform well in a structured classroom environment (Carlson and Wang, 2007; Simonds, Kieras, Rueda, and Rothbart, 2007). In addition to the relationship executive functioning skills have with academic

achievement, there is emerging evidence that suggests poverty-related stressors have a significant impact on executive functioning processes.

Executive Functioning and Poverty-Related Stress. Many studies have suggested that the development of adequate executive functioning skills is significantly affected by environments similar to those experienced by low-income urban youth, which are often characterized by chaos, lack of structure, little routine and exposure to multiple stressors. This is due to the fact that executive functioning skills develop through interactions between the prefrontal cortex and the outside environment (Jensen, 2009). In fact, there have been recent studies suggesting that the physiological stress response of a child in a highly adverse environment influences the executive system of the prefrontal cortex (Blair et al., 2011; Raver, Blair, Willoughby, and The Family Life Project Key Investigators, 2012). Specifically, chronic exposure to stressors can cause the brain to undergo adverse physical changes due to its forced adaptation under hostile conditions (Jensen, 2009). On a cellular level, neurons of individuals undergoing chronic and acute stressors have been found to shrink in the brain's frontal lobes. This damage to cells in the frontal lobes in turn negatively affects the development of the executive functions controlled in that region (Jensen, 2009).

In addition to the impact of environmental stress on executive functioning related brain functions, studies have also looked at the relationship between specific stressors found in urban poverty and executive functioning skills. Particularly, SES has been found to be associated with various executive functioning skills (i.e. working memory, attention shifting, inhibitory control, and cognitive flexibility) in children (Blair et al., 2011; Farah et al., 2006; Sarsour et al., 2011). For example, a study examining low SES and specific brain systems found that children of low SES background performed worse than children of middle SES background on prefrontal

executive system tasks (i.e. working memory, inhibition, planning organization) (Noble, Norman, and Farah, 2005). Similarly, a recent study examining the association of chronic poverty and executive functioning skills (working memory, attentional set shifting, and inhibitory control), found that children whose families were exposed to lower financial strain performed higher on tasks of executive functioning (Raver, Blair, Willoughby, and The Family Life Project Key Investigators, 2012).

In addition to the stressor of SES, another study found links between other stressors and executive functioning skills. Specifically, Fishbein and colleagues (2009) examined community and interpersonal stressors and their association with “neurocognitive functioning” in a sample of 10- 12 year old, predominately Hispanic, low-income youth. Authors hypothesized that children reporting increased stress would have more neurocognitive deficits than children reporting less stress. Neurocognitive functioning in this study refers to executive cognitive and emotional regulatory processes. Tasks used to test neurocognitive functions included a task of general intellectual functioning; a risk taking measure known to activate portions of the prefrontal cortex; a task assessing planning, execution, monitoring, working memory, and inhibition (Tower of London task); a task tapping cognitive flexibility/shift (Stroop Color Word); and a task measuring inhibition (The Logan Stop-Change task). Stressors examined included community stressors (witnessing neighborhood violence and children’s perceptions of problems in their neighborhood), as well as personal stressors (i.e. emotional abuse, physical abuse, parent stress, school stress). Results found personal stressors to be associated with processes of intelligence and decision-making. However there was no significant association between exposure to violence and neurocognitive functions. (Fishbein et al., 2009).

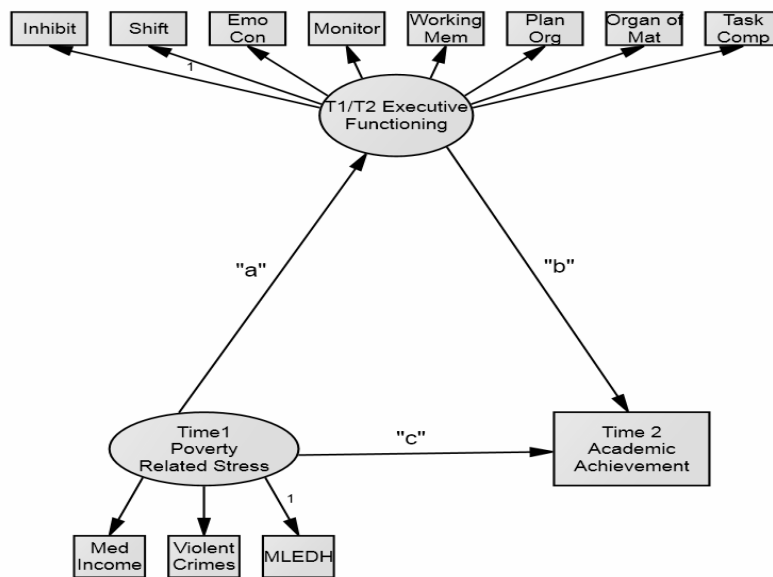
Rationale

It is well established that poverty and related environmental stressors (i.e. exposure to violence) are significantly associated with low academic achievement. It has also been found that the achievement gap between low-income and higher income students increases over time. However less is known about the mechanisms linking poverty and other stressors with these achievement gaps. Bronfenbrenner's model of bio-ecological human development (Bronfenbrenner and Morris, 1998; Bronfenbrenner and Evans, 2000) points to proximal processes as possible facilitators of the relationship between poverty-related stress and achievement. A similar model suggested by Perkins and Graham-Bermann's (2012) posits that processes of executive functioning such as self-regulation may mediate the effects of poverty-related stress on achievement. Recent studies have supported this model through findings that executive functioning skills play an important role in academic achievement. The model is also supported by findings that executive functioning skills are significantly impacted by poverty and related environmental stressors. However, the following gaps in the literature still remain: 1) there are currently no studies which explore executive functioning as a mediator of the relationship between poverty-related stress and academic achievement; and 2) there are currently no studies that explore the impact of executive functioning on academic achievement in a sample of predominately urban, minority youth.

Based on previous literature, the goal of the current study is to address these gaps through the following theoretical model shown below (Figure 1.). In this model, the eight processes make up the construct of executive functioning, while major life events and daily hassles, income, and exposure to violence make up the variable of poverty-related stress. Executive functioning skills

serve as a mediator in the relationship between poverty-related stressors and academic achievement

Figure 1. Theoretical Model of Executive Functioning as a Mediator in the Relationship between Poverty-Related Stress and Academic Achievement



Statement of Hypotheses

Hypothesis I. The observed variables of Time 1 median household income, Time 1 number of violent crimes, and Time 1 major life events/daily hassles will serve as indicators for the latent variable of Time 1 poverty-related stress for the current sample.

Hypothesis II. The observed Time 2 variables of inhibition, shift, emotional control, monitor, working memory, planning/organization, organization of materials, and task completion will serve as indicators for the latent variable of Time 2 executive functioning deficits for the current sample.

Hypothesis III. Executive functioning will serve as a partial mediator in the relationship between Time 1 poverty-related stress and Time 2 grade point average (using recommendations for testing partial mediation by Cole and Maxwell, 2003).

- A. Time 1 poverty-related stress will have a direct effect on Time 2 executive functioning, while controlling for Time 1 executive functioning. This will be tested by the estimation of path “a” in the partial mediational relationship.
- B. Time 1 executive functioning will have a direct effect on Time 2 grade point average, while controlling for Time 1 grade point average. This will be tested by the estimation of path “b” in the partial mediational relationship.
- C. Time 1 and Time 2 executive functioning will serve as a partial mediator in the association between T1 poverty-related stress and Time 2 grade point average mediated by the product of both paths, “ab” resulting in a nonzero estimate.

Research Questions

Research Question I: Will the observed variables of Time 2 psychomotor vigilance reaction time, tasks switching cost, and incorrect go/no-go reaction time serve as indicator variables for the latent measure of laboratory executive functioning skills in the current sample?

Research Question II: Will laboratory executive functioning serve as a partial mediator in the relationship between Time 1 poverty-related stress and Time 2 grade point average? If so, will the model be a better fit for study data than the eight measures of self-report contextual executive skills?

PART II. METHOD

This study was part of a larger longitudinal study examining the effects of stress on adolescent psychological and physiological health and learning across time. Participants were recruited at two time points, with Time 1 occurring approximately 6 months prior to Time 2.

Research Participants

The sample in this study consisted of 262 participants at Time 1 (mean age = 14.55). It included 119 males (45.4%) and 143 females (54.6%). Participants ranged in grades from 6- 12 (36-sixth graders, 20-seventh graders, 26-eighth graders, 37- ninth graders, 54-tenth graders, 59-eleventh graders, and 30-twelfth graders). Race/Ethnicity percentages were as follows: 34.4% African American, 20.2% Biracial or Multi-racial, 19.5% Hispanic or Latino, 9.9% Asian or Asian American, 13% Caucasian or White, .8% American Indian or Alaskan Native, , and 1.9% “Other”. Demographic information was missing for 1 participant. For Time 2 variables, the sample consisted of 138 participants (mean age = 15.17). At Time 2 it included 57 (41.3%) males and 81(58.7%) females. Time 2 Race/Ethnicity percentages were as follows 37.0% African-American, 19.6% Hispanic or Latino, 18.1% Bi-Racial or Multi-Racial, 13.8% Asian or Asian American, 8.7% Caucasian, 2.2% other, and .7% American Indian or Alaskan Native. According to census data of family median income, there was a large range of incomes within the sample (\$155, 500-\$11, 650). Figures 2 and 3 display a histogram of income frequencies at Time 1(n = 228) and Time 2 (n = 124)

Figure 2. Time 1 Income Frequencies

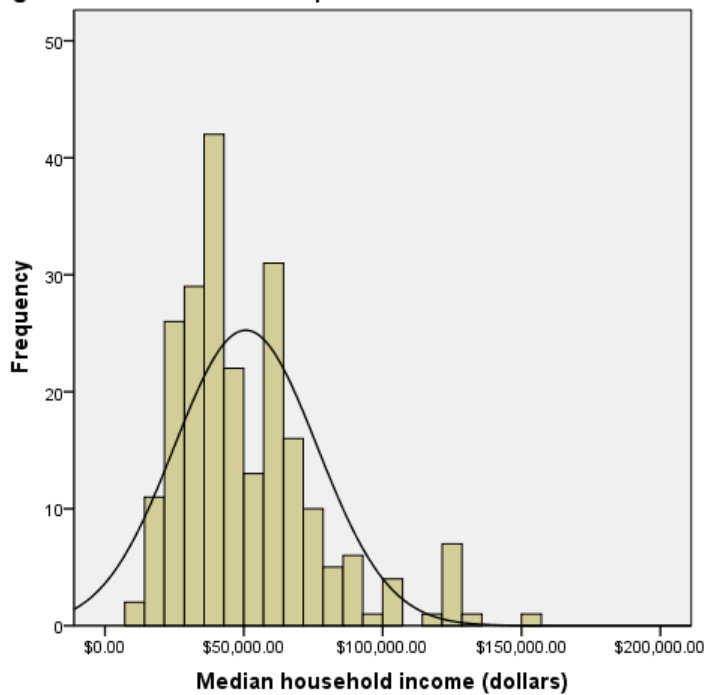
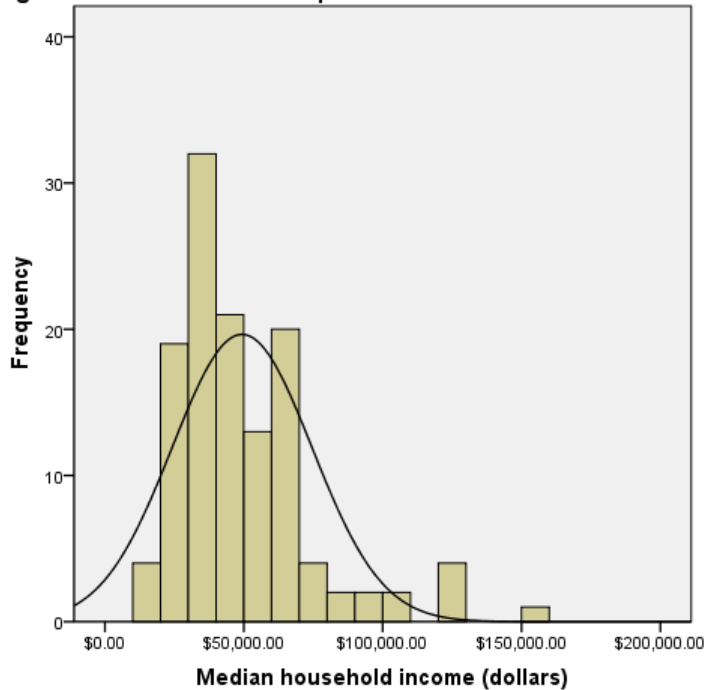


Figure 3. Time 2 Income Frequencies



Procedure

The larger longitudinal study was approved by the institutional review boards of both DePaul University and Chicago Public Schools. Participants were recruited from three diverse urban schools (two K-8th; one high-school). Research assistants visited classrooms during designated periods to describe the study, go over assent forms, and distribute consents and parent report forms to students who assented to be in the study. Interested participants were transported to DePaul's campus for youth protocol administration during 2 time points, 6 months apart. During each time point, data was collected over 5 consecutive Saturdays. During these data collection days, student were assigned to one of four groups and participated in clinical interviews, online surveys, and physiological measures of stress response. The survey and laboratory task portion of the study from which measures of the current study were completed, took approximately 1.5 hours. Participants completed surveys and interviews individually; however they arrived and left as part of assigned groups. Breakfast, lunch, and dinner were provided on data collection days, with time set aside for college tours and other informational sessions for participants. Information for the current study was taken during a portion of the data collection in which participants completed questionnaires through an online survey system. Participants received \$50 in Target, Old Navy, or Best Buy gift cards as incentive for their participation in the study.

Materials

Poverty-related stress. The latent variable of poverty-related stress from the proposed theoretical model was measured through three indicator variables. These three variables were income, exposure to violence, and major life events/daily hassles.

Median Family Income. Median family income was extracted from the United States Census website for each participant. This was done by first; using the address of each participant to obtain a geocode through which census tract data would be obtained. Next, each census tract was linked to information about participants living within that area. This database was accessed through the Census Bureau website link at <http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml>. On the website, the option “Decennial Census” located on the bottom right was first selected. Next, the option “Geographies” was used to select the “Census Tract” which included specifying “Illinois” under state, “Cook” under county, and “All census tracts within Cook County, Illinois.” This was followed by selecting “Topics” found on the bottom left side of the website. Within the search option, the file name Median Income in the Past 12 months (in 2012 inflation adjusted in dollars) was selected. This was in the dataset “2012 ACS-5 year estimates”. This document was then saved in Microsoft Excel, and median household income was extracted.

Exposure to violence. Stress related to community violence was measured using crime statistics available through the Chicago Police Department (Chicago Police Department, 2013). In particular, the information on crime statistics from September 1, 2012 - June 1, 2013 was obtained. Crime data were gathered from the district and beat of each participant by using their address. The definition of violent crime used to calculate the variable came from the Chicago Police Department Website and includes homicide (1st and 2nd degree), criminal sexual assault,

robbery, aggravated assault, and aggravated battery. Total raw scores were used for the time period indicated for each participant.

Major life events and daily hassles. To measure major life events the 87-item Urban Adolescent Life Experiences Scale (UALES; Allison and Burton, 1999) was used. The design of the UALES is based on the Adolescent Perceived Events Scale (APES; Compass, Davis, Forsythe, and Wagner, 1987), a well-established, valid, and reliable measure of stress, normed on predominantly middle-class White adolescents. The UALES items were generated by low-income urban predominantly African American youth (Allison and Burton, 1999). Respondents are asked to rate the frequency with which they have been exposed to a series of the stressful experiences on a 5 point scale (i.e. 1 = Never, 2 = has Happened Once or Twice, 3 = Happens Once a Month, 4 = Happens Once a Week, and 5 = Happens Once a Day), with higher numbers indicating greater frequency of exposure. The UALES assesses lifetime chronic and episodic stress in four content areas: (a) school, (b) family/community, (c) peer, and (d) personal, and it measures both major life events and daily hassles. Independent raters identified UALES items that assess major life events and daily hassles. Inter-rater reliability was .90. Sample major life event items include, “A friend has died,” “I broke up with a boyfriend or girlfriend,” and “A friend goes to jail.” Sample daily hassle items include, “I have poor school supplies” and “I have transportation problems.” Test-retest reliability of the UALES was .84 in a pilot study of 6th through 12th graders (Allison and Burton, 1999). The original measure includes positive and negative events. In the present study, the measure was shortened to the 111 negative events, as positive events have not been shown to predict psychological problems (Siegel and Brown, 1988). The modified version of the UALES used in the present study had a test-retest reliability of .84 (Allison et.al., 2004).

Executive Functioning. The latent variable of executive functioning deficits from the proposed theoretical model was measured through eight indicator variables. These indicator variables are subscales of the Behavior Rating Inventory of Executive Function-Self-Report Version (BRIEF-SR; (Gioia, Isquith, Guy, and Kentworthy, 2000) and include the following:

Planning/organization. Planning and organization is the ability to be future-oriented when managing the demands of a task. The child who has sufficient planning and organizing skills is able to set goals and create steps to help achieve those goals. Once task requirements are placed in front of the child, he or she also has the ability to take care of present task demands. Examples of planning and organization skills include “I start projects without the right materials” and “I don’t plan ahead for future activities”.

Task completion. Task completion is the ability to start a task or activity and follow it through to completion. Children that have sufficient task completion are also able to complete task appropriately and in a timely manner. Task completion is not often considered an executive function, but is the outcome of working memory, planning and organization, and inhibitory control. Examples of task completion skills include, “I have problems finishing long term projects” and “I have difficulty finishing a task on my own”.

Self-monitoring. Self-monitoring is the ability to check work habits, and monitor the effects of one’s behavior. Children with the ability to self-monitor are able to measure their performance on a task or activity against a standard that they know is expected. Therefore children who have deficits in self-monitoring are often found to rush through tasks, make careless mistakes, and rush through their schoolwork. Examples of monitoring items include “I

am not aware of how my behavior affects others” and “I don’t notice that my behavior causes negative reactions until it’s too late”.

Working memory. Working memory is the ability to retain information and use it to complete tasks. It also encompasses the ability to maintain focus and attention. Examples of working memory items include “I forget to hand in my homework, even when it’s completed” and “I have trouble with jobs or tasks that have more than one step”.

Organization of materials. Organization of materials is the capacity to physically have information in order, as well as the ability to keep written and oral information organized once it is received. Children with this skill are able to keep track of school materials and keep things such as homework assignments organized. Children experiencing difficulties in this area usually have a disorganized way of approaching tasks, become easily overwhelmed, and often fail to express themselves properly in oral and written tasks (Gioia, Isquith, Guy, and Kentworthy, 2000). Examples of organization of materials skills include “My desk/workspace is a mess” and “I lose things”.

Inhibition. Inhibition is a skill originally identified by Barkley (1990) and is described as the ability to resist behavior as well as the ability to not act impulsively. A child with adequate inhibition skills is able to stop his or her behavior, actions, and/or thoughts at the appropriate time. Examples of inhibition items include “I have trouble sitting still” and “I get in other people’s faces”.

Shift. Shift is the capacity of a person to move from one situation, activity, or problem to the next with little difficulty. As circumstances change or demand different skills, children who can adequately shift will be able to be flexible with their thinking and respond appropriately to

the situation. On the other hand, children with deficits in shifting abilities will display behavior such as rigidity, poor problem solving, difficulties with transitions, and difficulties dealing with disappointment. Examples of shift items include, “I have trouble accepting a different way to solve a problem” and “I get upset by a change in plans”.

Emotional control. Emotional control is the executive function ability to regulate emotional responses. Children with adequate emotional control skills can think rationally in order to temper their feelings. Without adequate emotional control skills, some children may experience explosive reactions that are out of proportion to the circumstances. Examples of emotional control items include, “I overreact to small problems” and “I have angry outbursts”.

These eight skills are all subscales measured on the BRIEF-SR. The BRIEF-SR consists of 80 items rated using a 1 to 3 scale in which 1 = “never a problem”; 2 = “sometimes a problem”; and 3 = “often a problem”. Items are summed to create scores for all eight subscales. Higher raw scores, percentiles, and t-scores indicate greater degrees of executive dysfunction; with a t-score of 65 marking potential clinical significance (Gioia, Isquith, Guy, and Kentworthy, 2000).

The BRIEF was chosen for the theoretical model over more skills based measures of executive functioning due to the ability to assess multiple factors of executive functioning in a single measure. In addition, inconsistencies between real life application of executive functioning skills and performance on skills-based executive measures have often been found (Anderson, 2002). Given that skills based measures of assessment require novelty and are often performed in a structured, quiet setting, they likely do not represent the settings in which youth are required to navigate academic tasks. Therefore, this study elected to use a contextual-based

self-report of executive difficulties for main hypotheses, in order to gain a better understanding of behavioral indications of executive skills that may impact achievement in school. However, it is recommended that the assessment of executive functioning include other sources of information (Anderson, 2002). Therefore 3 skills-based laboratory measures of executive processes were also assessed and compared with results of the BRIEF subscales.

Executive Functioning Laboratory Measures. Three laboratory measures were used to compare model fit against contextual based measure of the BRIEF. The battery of laboratory measures assessed at Time 1 and Time 2 included measures of shift, attention, and inhibition. These tests were administered on an IPAD where reaction times and error were downloaded after administration. The following is a detailed explanation of each test:

Task switching test (Meiran, 1996). The task switching test was used to assess shifting ability. During this task, participants were briefly presented with one digit at a time (1-9, except 5) in the center of a computer screen and asked to use two different rules in order to correctly categorize the digit. One rule asks the participants to decide if the digit appearing in the blue box is greater or less than 5, and to press the corresponding button on the left side of the screen. The second rule asks participants to decide if the digit appearing in the pink box is odd or even, and to press the corresponding button on the right side of the screen. These two rules are randomly presented by visual cue via the two colors, therefore requiring participants to switch attention and inhibit the proponent response of categorizing the digit according to the same rule as the previous trial. Results of the task switching test are obtained in what is determined “task-shift cost”. Task-shift cost is the decrease in performance associated with switching from one task to another. The time taken between tasks is said to be reflective of processes used by individuals that happen prior to the execution of a second task (Meiran, 1996). The variable of task shift cost

was calculated by subtracting the reaction time from the trials , which the participant is not required to switch tasks from reaction times in the trials , which the participant is required to switch tasks (Meiran, 1996). The lower the amount of calculated task switch cost, the better the participant's performance.

Psychomotor vigilance task (PVT) (Wilkinson and Houghton, 1982). The PVT measures participant attention, vigilance, and reaction times. Participants were presented with a stimulus, a red dot that appears in the middle of the screen. Participants were requested to react by pressing the, "Hit me" button as soon as the red dot appears on the screen. The appearance of the red dot is spaced at random time intervals. Reaction times (in millisecond) to the stimuli were recorded. Faster reaction times indicated better performance.

Go/no-go task (Simmonds, Pekar, and Mostofsky, 2008). In the Go/No-Go task participants are instructed to respond quickly to the presentation of a certain stimulus (stimulus A) while instructed to inhibit response to another stimulus (stimulus B). During this task, response inhibition was measured by the ability of the participant to withhold response for stimulus B or the No-Go stimulus. In this study, reaction time during the no-go task was used as an indicator of inhibition, which faster reaction timed indicated decreased inhibition skills.

Academic Achievement. Academic achievement was measured through Time 1 (Fall of 9th grade year) and Time 2 (Spring of the data collection year) unweighted grade point average (GPA) for each participant. Grades were coded on a 4-point scale and calculated into a cumulative GPA score for the semester. Grades were obtained from the school with signed permission from parents/guardians. However due to failure of parents to give permission for some participants, data was only obtained from 86 of the 124 participants at Time 2.

PART III. RESULTS

Overview

Results are presented in three steps. First, results of preliminary analyses are reported, including descriptive statistics of study variables; results of t-tests examining possible differences among these variables; and correlations among independent, dependent, and mediator variables. In addition, results of measurement models are reported for the latent variables of executive functioning and poverty-related stress. Second, results of the proposed main analyses are reported for each hypothesis according to the steps outlined in Cole and Maxwell (2003) for testing partial mediation in studies with only a two-wave design.

Preliminary Analyses

Data were assessed for accuracy, outliers, and biases of the sample. In addition, all continuous variables were examined for both skewness and kurtosis, with all in question demonstrating normality scores within acceptable limits (less than 3.00 and 10.00 respectively (Kline, 2005).

Missing Data Analyses. Attrition between Time 1 and Time 2 resulted in missing data for the sample. In order to assess patterns or randomness of the missing data, analysis of attrition bias was performed. Pearson chi-square tests were run for demographic variables (i.e. race/ethnicity, gender, and grade). P-values were obtained to determine whether missing data were related to these variables. Results of the analysis revealed a significant difference in grade among participants were in Time 1 vs Time 2 ($\chi^2(6) = 35.22, p = .00$). Specifically analysis revealed a higher percentage of participants in 11th grade at Time 2. However further review revealed that there was a majority of 11th graders at both time points (45% at Time 1 and 48% at

Time 2). There were no significant differences between Time 1 and Time 2 participants only on race/ethnicity or gender.

Descriptive statistics. Descriptive statistics for Time 1 poverty-related stress measures (i.e. major life events/daily hassles, median income, and number of violent crimes), Time 1 and 2 GPA scores, as well as Time 1 and 2 executive functioning skills are presented in Table 1. Due to a large amount of missing data, the number of subjects (N) was calculated through pairwise deletion for each variable.

Table 2. Means and standard deviations for major life events/daily hassles, Executive Functioning Scores, and GPA separated by gender.

		Time 1			Time 2		
		N	M	(SD)	N	M	(SD)
Median Income	Male	136	54,190	27,102			
	Female	169	50,258	27,098			
Number of Violent Crimes	Male	135	2,515	944			
	Female	167	2,689	1,025			
major life events/daily hassles	Male	158	152.81	(23.44)			
	Female	187	151.10	(19.27)			
Inhibition	Male	166	18.19	(5.66)	73	16.60	(5.04)
	Female	192	19.27	(4.87)	99	17.49	(5.17)
Shift	Male	165	14.92	(4.42)	73	12.95	(4.00)
	Female	192	16.08	(4.02)	99	14.16	(4.14)
Emotional Control	Male	165	13.87	(4.59)	73	12.26	(3.70)
	Female	192	16.59	(4.74)	99	14.69	(4.89)
Monitor	Male	165	7.45	(2.49)	73	6.41	(2.00)
	Female	192	7.65	(2.34)	99	6.72	(2.38)
Working Memory	Male	165	18.34	(5.84)	73	16.45	(5.16)
	Female	192	19.84	(5.41)	99	17.89	(4.94)
Planning/Organization	Male	165	20.92	(6.50)	73	18.38	(5.74)
	Female	192	21.54	(6.00)	99	19.24	(5.30)
Organization of Materials	Male	165	11.18	(3.54)	73	10.13	(3.15)
	Female	192	11.85	(3.34)	99	11.31	(3.52)
Task Completion	Male	165	15.80	(5.21)	73	13.64	(4.38)

	Female	192	16.54	(4.84)	99	14.72	(4.26)
Fall GPA	Male	68	2.49	(.84)			
	Female	70	2.69	(.81)			
Spring GPA	Male				68	2.51	(.78)
	Female				70	2.75	.86
PVT*	Male	118	497.78	(117.1)	84	521.8	(138.4)
	Female	141	521.42	(167.1)	91	508.4	(127.7)
Task Switch Cost*	Male	113	112.77	(182.8)	56	128.3	(138.7)
	Female	137	172.18	(174.3)	64	139.7	(147.1)
Incorrect No/Go*	Male	101	417.75	(128.1)	65	423.5	(108.0)
	Female	108	412.75	(86.8)	67	417.3	(93.7)

*Measured by reaction time in milliseconds

Gender differences. T-tests were used to test for possible gender differences among Time 1 poverty related stress measures (i.e. major life events/daily hassles, median income, and number of violent crimes); Time 1 and Time 2 executive functioning skills; and Time 1 and 2 GPA. At Time 1, there were significant gender differences in the executive functioning skills of shifting, emotional control, and working memory. Specifically, females at Time 1 reported more difficulty in their ability to shift ($t(355) = 2.61, p < .01$), in emotional control ($t(355) = 5.46, p < .01$), and in working memory skills ($t(355) = -2.51, p < .05$). There were also gender differences in the executive functioning laboratory measure of task switching cost at Time 1. Specifically, females displayed slower reaction times than males during the task switching exercise, demonstrating more difficulty shifting between tasks ($t(248) = -2.62, p < .01$). At Time 2, there were significant gender differences in the executive functioning skills of emotional control and organization of materials. Consistent with Time 1, females at Time 2 reported more difficulty in emotional control ($t(170) = 3.56, p < .01$) and their ability to organize materials ($t(170) = 2.38, p < .05$).

Age Differences. T-tests were used to test for possible age differences among Time 1 poverty related stress measures (i.e. major life events/daily hassles, median income, and number

of violent crimes); Time 1 and Time 2 executive functioning skills; and Time 1 and 2 GPA. Age was coded into a categorical variable of participants who were over 15 (older adolescents) and under 15 (younger adolescents). At Time 1, there were significant age differences found for median income, number of violent crimes, and major life events and daily hassles. Specifically, results indicated that older adolescents had higher median family income ($t(225) = 2.10, p < .05$); live in neighborhoods with more violent crimes ($t(222) = .22, p < .01$); and experienced more major life events and daily hassles ($t(243) = .12, p < .01$) than younger adolescents. Older adolescents also reported more deficits on Time 1 executive skills of shift ($t(256) = 3.25, p < .01$); emotional control ($t(256) = 2.35, p < .05$); monitor ($t(256) = 3.14, p < .01$); working memory ($t(256) = .85, p < .01$); planning/organization ($t(256) = .83, p < .01$); and task completion ($t(256) = .47, p < .01$). Similarly at Time 2, older adolescents reported greater executive functioning deficits on shift ($t(129) = 2.53, p < .05$); monitor ($t(129) = 2.05, p < .05$); planning/organization ($t(129) = 2.39, p < .05$) and task completion ($t(129) = 2.58, p < .05$) skills. On executive functioning laboratory measures, older adolescents showed better skills than younger adolescents on tests of attention (Time 1 PVT- $t(256) = 3.3, p < .01$; Time 2 PVT- $t(173) = 2.81, p < .01$) and on a measure of shifting/cognitive flexibility at Time 2 ($t(118) = 2.81, p < .01$). However younger adolescents showed better performance on a measure of response inhibition at Time 1 ($t(207) = 3.02, p < .01$).

Correlation analyses. A Pearson product-moment bivariate correlation analysis was employed to analyze the correlations among Time 1 poverty-related stress variables (i.e. median income, number of violent crimes, and major life events/daily hassles), Time 1 and Time 2 Executive Functioning Skills, and Time 1 and 2 GPA. Correlations are reported for the total sample in Table 4. Correlations indicated age to be negatively related to number of violent

crimes at Time 1, and positively related to median income, major life events/daily hassles, and all executive functioning deficits at Time1 and Time 2. However, neither median income nor number of violent crimes was found to have a relationship with executive functioning skills or GPA at either time point. Median income and number of violent crimes was also not found to have a relationship with major life events/daily hassles at Time 1. Alternatively, major life events/daily hassles was positively related to all executive functioning skills at Times 1 and 2, and negatively related to GPA at Times 1 and 2.

In addition to age and major life events/daily hassles, Time 1 GPA was negatively related to difficulties in executive functioning skills of inhibition and task completion at Time 1. Time 1 GPA was also related negatively with executive functioning deficits of inhibition, shift, monitor, working memory, planning/organization, organization of materials, and task completion at Time 2. In addition to major life events/daily hassles, Time 2 GPA was negatively related to executive functioning deficits of inhibition and task completion at Time 1. Time 2 GPA was also negatively related to executive functioning deficits of inhibition, shift, monitor, working memory, planning/organization, organization of materials, and task completion at Time 2. As expected, Time 1 GPA was positively related to GPA at Time 2. Similarly, all executive functioning skills at Time 1 and Time 2 were positively related to all other executive functioning skills at the two time points.

Table 3. Correlations Among Predictor, Mediator, and Outcome Variables

1. Age	1.00	.14*	-.19**	.34**	-.19	-.12	.12	.23**	.19**	.22**	.20**	.25**	.14*	.24**	.18*	.32**	.23**	.31**	.24**	.33**	.21	.22*	.34**	.23	-.25**	-.25**	.04	.13	.27	.28	-.07
2. Income		1.00	-.45**	.05	.05	.07	.02	.04	.04	.04	.06	.04	.05	.06	.08	.00	.05	.04	.12	.09	.00	.03	-.01	.07	-.06	-.16	-.16	-.16*	-.16*	-.04	
3. VC			1.00	-.04	.02	.03	.01	.04	.06	.05	.05	.05	.12	.04	-.12	-.06	-.08	-.16	-.12	-.10	-.01	-.10	.10	.02	.00	-.03	.09	.09	.11	.11	
4. major life events/daily hassles				1.00	-.34**	-.33**	.43**	.36**	.39**	.38**	.40**	.40**	.33**	.39**	.37**	.44**	.37**	.34**	.36**	.42**	.38**	.37**	-.07	-.10	.03	.11	-.05	.09	.09	.09	
5. T1 GPA					1.00	.90**	-.33**	-.15	-.18	-.26*	-.22*	-.26*	-.23*	-.32**	-.23	-.09	.01	-.22	-.12	-.13	-.12	-.11	-.08	-.22	.15	-.15	.00	-.08	-.08		
6. T2 GPA						1.00	-.31**	-.11	-.18	-.26*	-.19	-.23*	-.21	-.29**	-.31	-.17	-.09	-.39*	-.17	-.29	-.23	-.20	-.16	-.33*	.13	-.05	-.07	-.11	-.11		
7. T1 IN							1.00	.74**	.77**	.65**	.74**	.74**	.63**	.70**	.51**	.45**	.40**	.53**	.49**	.43**	.37**	.43**	-.05	-.13	.07	.02	-.08	.02	.02		
8. T1 SH								1.00	.74**	.69**	.80**	.81**	.63**	.84**	.35**	.57**	.43**	.50**	.45**	.45**	.31**	.51**	-.04	-.13	.06	-.07	-.07	.05	.05		
9. T1 EC									1.00	.62**	.69**	.68**	.53**	.68**	.45**	.52**	.64**	.47**	.41**	.43**	.32**	.44**	.02	-.14	.06	-.03	-.07	.06	.06		
10. T1 Mon										1.00	.66**	.69**	.59**	.68**	.43**	.53**	.42**	.54**	.48**	.52**	.39**	.46**	-.01	-.11	.00	-.05	-.04	-.21*	.21*		
11. T1 WM											1.00	.86**	.77**	.83**	.41**	.53**	.38**	.50**	.58**	.48**	.46**	.51**	-.10	-.20**	.10	.05	-.10	.02	.02		
12. T1 PO												1.00	.78**	.88**	.35**	.53**	.39**	.48**	.53**	.57**	.47**	.54**	-.08	-.16*	.04	.03	-.07	.08	.08		
13. T1 OM													1.00	.69**	.26**	.44**	.33**	.38**	.53**	.56**	.65**	.45**	-.08	-.16*	.05	.03	-.02	.09	.09		
14. T1 TC														1.00	.33**	.53**	.35**	.45**	.44**	.48**	.33**	.57**	.00	-.11	.01	-.07	-.06	.09	.09		
15. T2 IN															1.00	.70**	.71**	.74**	.77**	.69**	.57**	.65**	-.07	-.03	.19*	-.22	-.11	.01	.01		
16. T2 SH																1.00	.77**	.75**	.75**	.80**	.61**	.84**	-.11	-.08	.17	-.21	-.11	.12	.12		
17. T2 EC																	1.00	.67**	.62**	.70**	.53**	.63**	-.07	-.06	.22*	-.28*	-.15	.07	.07		
18. T2 Mon																		1.00	.72**	.75**	.57**	.77**	-.08	.01	.12	-.33**	-.08	.12	.12		
19. T2 WM																			1.00	.83**	.78**	.77**	-.17*	-.18	.16	-.15	-.13	.02	.02		
20. T2 PO																				1.00	.81**	.86**	-.09	-.06	.13	-.27*	-.10	.06	.06		
21. T2 OM																					1.00	.67**	-.14	-.24*	.16	.04	-.10	.10	.10		
22. T2 TC																						1.00	-.10	-.09	.14	-.30**	-.10	.07	.07		
23. T1 PVT																							1.00	.73**	-.11	-.02	.63**	.30**	.30**	.30**	
24. T2 PVT																								1.00	-.13	-.17	.43**	.52**	.52**		
25. T1 TS																									1.00	.15	-.14	-.14	-.14		
26. T2 TS																										1.00	-.06	.03	.03		
27. T2 NG																											1.00	.25**	.25**		
28. T2 NG																												1.00	.25**		

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

Note: T1 = Time 1; T2 = Time 2; Eth/ = Ethnicity; VC = Number of Violent Crimes; major life events/daily hassles = Major life events/daily hassles; GPA = Grade Point Average; IN = Inhibition; SH = Shift; EC = Emotional Control; Mon = Monitor; WM = Working Memory; PO = Plan/ Organize; TC = Task Completion; PVT = Psychomotor Vigilance Task; TS = Task Switching Cost; NG = Incorrect No/Go

Primary Analyses

To test Hypothesis 1 and 2, as well as Research Question 1, measurement models of the latent variables of poverty-related stress and executive functioning were assessed through confirmatory factor analysis (CFA). CFA was run with maximum likelihood estimation using AMOS 19.0 (Arbuckle, 2010). Maximum Likelihood Estimation (MLE), deals with missing data by making use of all available data points. MLE is more robust to mild violations of normality assumptions and offers an improvement over pairwise deletion, which can result in poor fitting models or impossible solutions due to different *ns* for each covariance or correlation. (Kline, 2005; Arbuckle, 2010).

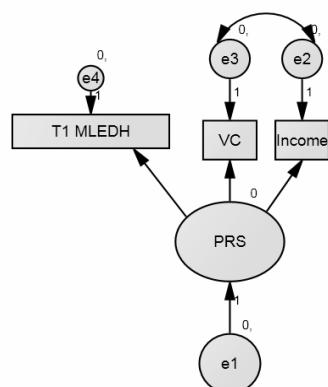
Several different fit indices were examined, including the most basic fit statistic, the model chi-square (χ^2). The chi-square tests the null hypothesis that the proposed model fits the data as well as the saturated model, which perfectly fits the data. Higher chi-square values indicate poorer fit (Kline, 2005). In addition, a non-significant chi-square indicates that the fit between the proposed model and the data is not significantly worse than the fit between the saturated model and the data.

In addition to the chi-square statistic, a number of alternate fit statistics were relied on to determine model fit including, CFI, TLI, and RMSEA (Byrne, 2005; Kline 2005). The Conditioned Fit Index (CFI), is based on the Normed Fit Index and has values ranging from zero to one. CFI values of .90 indicate a reasonably good fit (Kline, 2005) while values between .95 and 1 indicate a very good fit (Hu and Bentler 1999; Arbuckle, 2010). Given that significant chi-square values are often found in larger samples, the Tucker-Lewis Index (TLI) and Root-Mean-Square-Error of Approximation (RMSEA) were also evaluated for model fit. The Tucker-Lewis

Index serves to measure the improvement in model fit compared to a null model in which all variables are uncorrelated. While a TLI of greater than .90 has been considered adequate fit in past studies, good model fit has found to be indicated when TLI scores are greater than .95 (Hu and Bentler, 1999). The RMSEA uses a non-central chi-square distribution, which does not assume the proposed model to be perfect. The RMSEA estimates lack of fit compared to the saturated model. RMSEA values less than .05 indicate a good fit, while values ranging from .05 to .08 indicate an adequate fit (Kline, 2005).

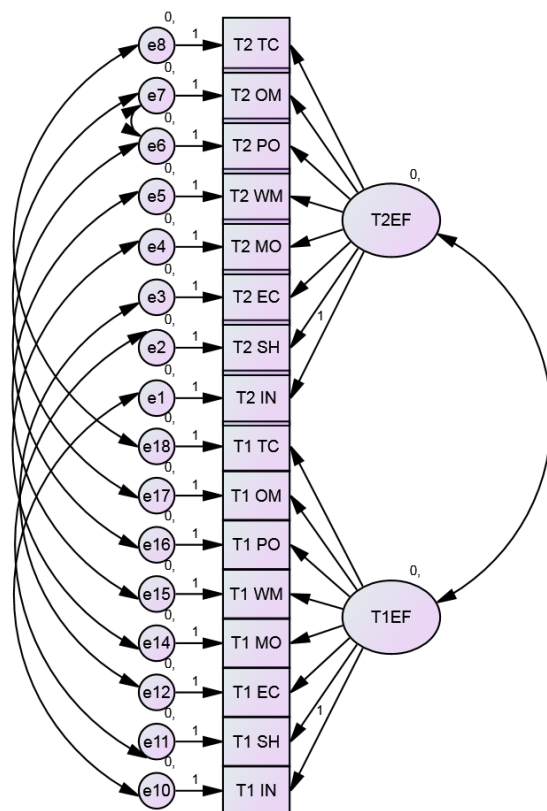
Hypothesis I: The observed variables of Time 1 median household income, Time 1 number of violent crimes, and Time 1 major life events/daily hassles will serve as indicators for the latent variable of Time 1 poverty-related stress for the current sample. According to the theoretical model, it was hypothesized that poverty-related stress would be associated with both executive functioning deficits and academic achievement. In the current study, poverty related stress is a latent variable composed of the census data of median household income and number of violent crimes. In addition, the latent variable of poverty-related stress is composed of a self-report of major life events and daily hassles experienced by adolescents. Structural equation modeling for Figure 4 could not take place due to these models being underidentified. Specifically, there were an infinite number of possible parameter estimates values for the current data. For the current model additional parameters were added in the form of demographic variables in order to control for gender, ethnicity/race, and age. However this alternate model was also underidentified.

Figure 4. Measurement Model of Latent Variable Poverty-Related Stress



Hypothesis II: The observed Time 2 variables of inhibition, shift, emotional control, monitor, working memory, planning/organization, organization of materials, and task completion will serve as indicators for the latent variable of Time 2 executive functioning deficits for the current sample. According to the theoretical model, it was hypothesized that executive functioning at Time 1 and Time 2 would serve as a partial mediator in the relationship between Time 1 poverty-related stress and Time 2 academic achievement. Results of the measurement model revealed reasonable/adequate model fit indices (CFI = .94, RMSEA = .08, RMSEA 90% C.I. = .07-.09, TLI = .92) despite a poor fit as indicated by the chi-square analysis ($\chi^2 (91) = 279.03, p = .00$).

Figure 5. Measurement Model of the Latent Variable of Executive Functioning



Hypothesis III: Executive functioning will mediate the relationship between Time 1 stress and Time 2 grade point average. Longitudinal, structural equation modeling was performed to test for evidence of partial mediation and overall model fit using AMOS 19.0 (Arbuckle, 2010). Mediation hypotheses for the current study were tested as recommended by Cole and Maxwell (2003). According to these authors, partial mediation can only be estimated in the current study given that data was collected at two time points. This “half-longitudinal” design precludes the capacity to test for significance of the mediation path, for which three time points are needed. Thus, Cole and Maxwell (2003) recommend a pair of longitudinal tests in

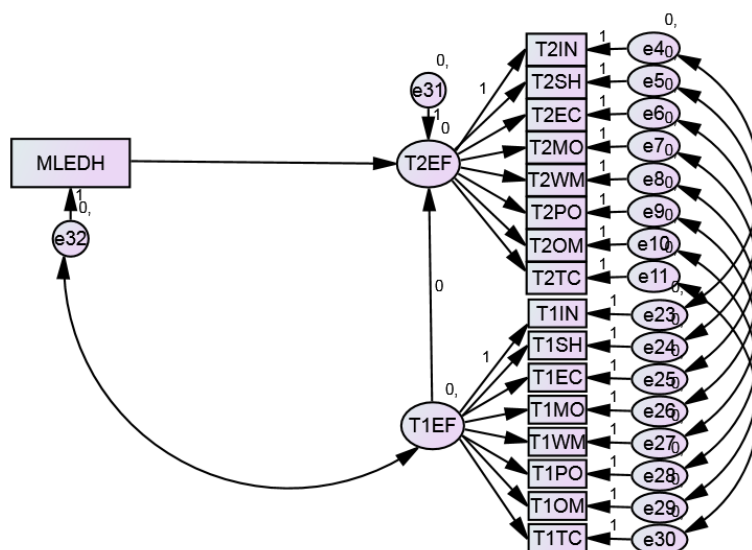
order to estimate partial mediation. First, path “a” is estimated in the regression of the Mediator at Time 2 onto the Independent Variable at Time 1 while controlling for the Mediator at Time 1. Second, path “b” is estimated in the regression of the Dependent Variable at Time 2 onto the Mediator at Time 1 while controlling for the Dependent variable at Time 1. It is assumed that the product of both paths provides an estimate of the mediation effect of the Independent Variable on the Dependent Variable through the Mediator. In these analyses both Time 1 and Time 2 executive functioning deficits will be examined together to test for partial mediation in the model. Given the absence of 3 time points stability is assumed by the presence of the mediator at Time 1 and Time 2 (Cole and Maxwell, 2003).

Hypothesis III-A. Time 1 poverty-related stress will have a direct effect on Time 2 executive functioning, while controlling for Time 1 executive functioning. This will result in the estimation of path “a” in the partial mediational relationship. According to the theoretical model, it was hypothesized that Time 1 poverty-related stress would be associated with executive functioning deficits at Time 2. This hypothesis was tested as part of the path “a” estimate described above. However, given the measurement model of poverty-related stress did not fit; the latent variable of poverty-related stress was substituted in the model by the observed variable of major life events and daily hassles. The major life events/daily hassles variable displayed correlations with both mediator and dependent variables, and therefore was used to analyze the association between Time 1 stress and Time 2 executive functioning deficits.

In this model, path “a” is estimated by the regression of the Time 2 executive functioning latent variable onto the Time 1 major life events/daily hassles variable, while controlling for Time 1 executive functioning. The model displayed reasonable/adequate model fit indices (CFI = .93, RMSEA = .08, RMSEA 90% C.I. = .07-.09) despite a poor fit as indicated by the chi-

squared analysis ($\chi^2(109) = 410.16, p < .00$) and chi-square degrees of freedom ratio (CMIN/DF = 3.7). Results of the test of path “a” in the partial mediation model suggest that Time 1 major life events/daily hassles is significantly associated with executive functioning at Time 2 ($\beta = .17, p < .05$).

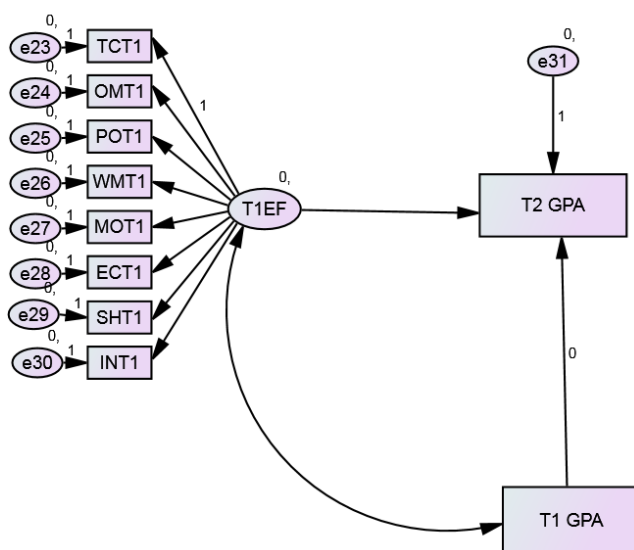
Figure 6. Model Examining the Direct Effect of major life events/daily hassles on Executive Functioning



Hypothesis III-B. Time 1 executive functioning will have a direct effect on Time 2 grade point average, while controlling for Time 1 grade point average. This will result in the estimation of path “b” in the partial mediational relationship. According to the theoretical model, it was hypothesized that Time 1 executive functioning deficits would be associated with grade point average (GPA) at Time 2. This hypothesis was tested as part of the path “b” estimate described above. Model 2 (Figure 3) tested this association. In this model, path

“b” is estimated by the regression of GPA at Time 2 onto executive functioning at Time 1, while controlling for GPA at Time 1. The model displayed overall adequate-to-good model fit indices (CFI = .97 TLI = .95, RMSEA = .08, RMSEA 90% C.I. = .06-.10) despite a poor fit as indicated by the chi-square analysis ($\chi^2(32) = 89.99, p = .00$). However, results of the test of path “b” in the partial mediation model were not significant, suggesting that Time 1 executive functioning was not significantly associated with GPA at Time 2 ($\beta = -.026, p > .05$).

Figure 7. Model Examining the Direct Effect of Executive Functioning on GPA



Hypothesis III-C. Time 2 executive functioning will serve as a partial mediator in the association between T1 poverty-related stress and Time 2 grade point average when the product of both paths, “ab” results in a nonzero estimate. According to the theoretical model, it was hypothesized that Time 2 executive functioning would serve as a mediator of the association between Time 1 poverty-related stress and Time 2 grade point average. Based on the recommendations by Cole and Maxwell (2003) for mediation analysis with half longitudinal

data, the product of both paths (“ab”) would provide an estimate of this mediation effect.

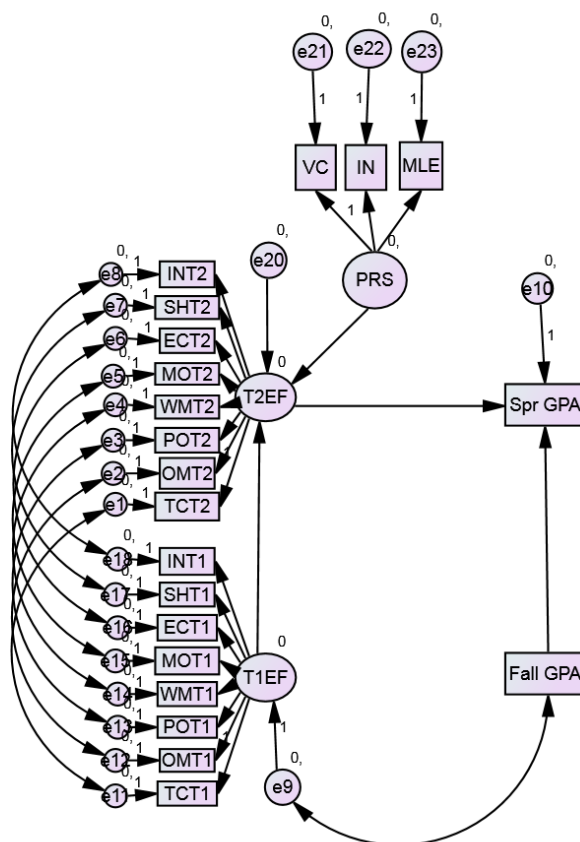
Analysis was first done using the originally proposed latent variable of poverty related stress.

The model displayed overall poor model fit indices (CFI = .90 TLI = .87, RMSEA = .09,

RMSEA 90% C.I. = .08-.10) and poor fit as indicated by the chi-square analysis (χ^2 (177) =

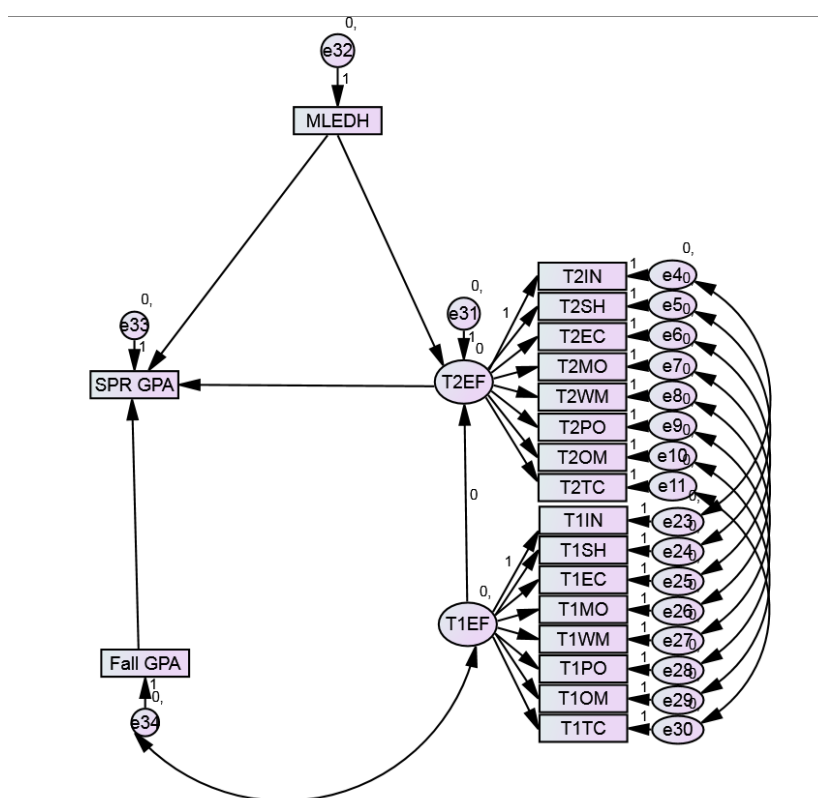
530.46, $p = .00$). Results of the test of path “a” ($\beta = .19$, $p > .05$) and “b” ($\beta = -.12$, $p > .05$) in the partial mediation model were not significant.

Figure 8. Model Examining Executive Functioning as a Partial Mediator of Poverty Related Stress and GPA.



Analysis was also conducted with a second model using the variable major life events/daily hassles to substitute for poverty related stress. This model also displayed overall poor model fit indices (CFI = .91 TLI = .88, RMSEA = .09, RMSEA 90% C.I. = .08-.10) and poor fit as indicated by the chi-square analysis ($\chi^2(142) = 437.32, p = .00$). Results of the test of path “a” ($\beta = .5, p > .05$) and “b” ($\beta = -.13, p > .05$) in the partial mediation model were not significant.

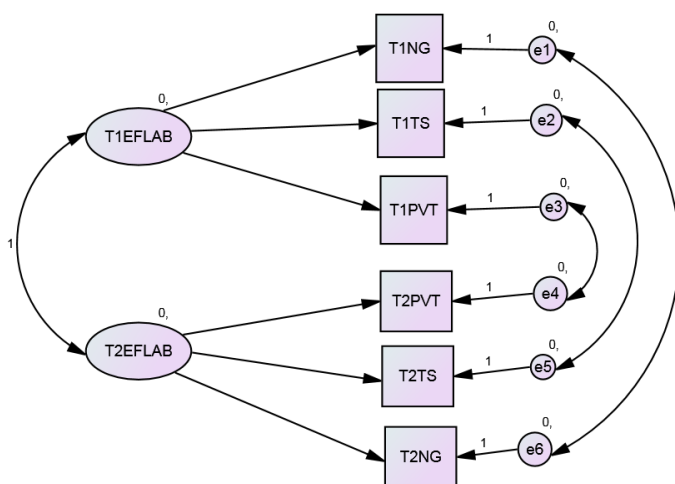
Figure 9. Model Examining Executive Functioning as a Partial Mediator of major life events/daily hassles and GPA



Research Question I: Will the observed variables of Time 2 psychomotor vigilance reaction time, tasks switching cost, and incorrect go/no-go reaction time Go/No-Go task serve as

serve as indicator variables for the latent measure of laboratory executive functioning skills in the current sample? Given that the primary assessment of executive functioning in the current study is based on self-report, a measure of performance on executive functioning skills-based tasks was also given to assess skills. A measurement model of these skills was assessed to determine model fit of the latent variable executive functioning with executive functioning performance measures assessing shifting, inhibition, and attention. Results were unable to be interpreted due to being underidentified.

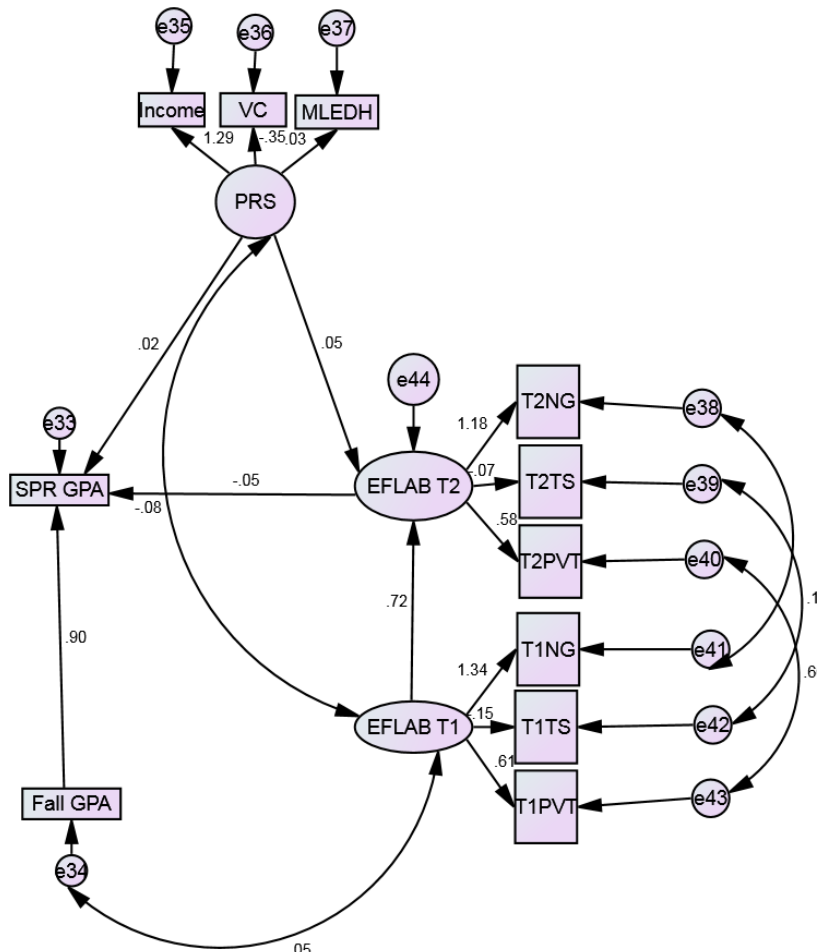
Figure 10. Measurement Model of Latent Variable Laboratory Executive Skills



Research Question II: Will laboratory executive functioning serve as a partial mediator of the relationship between Time 1 poverty-related stress and Time 2 grade point

average? If so, will the model be a better fit to study data than the eight measures of self-report executive deficits.? The model displayed overall good model fit indices (CFI = .97 TLI = .95, RMSEA = .04, RMSEA 90% C.I. = .00-.06), as well as good fit as indicated by the chi-square analysis ($\chi^2(32) = 49.17, p = .07$). However, results of the test of path “a” ($\beta = .00, p > .05$) and “b” ($\beta = -.00, p > .05$) in the partial mediation model were not significant.

Figure 11. Model Examining Executive Functioning as a Partial Mediator of major life events/daily hassles and GPA



PART IV. DISCUSSION

Environmental stressors related to urban poverty often result in a myriad of outcomes that can impact adolescents emotionally, behaviorally, and academically (Conger et al., 2002; Grant et al., 2003; Rouse and Fantuzzo, 2009; Wadsworth and Berger, 2006). In fact, in the area of academic achievement, a gap has been found between children from low socioeconomic households and their higher SES counterparts (Caro, McDonald, and Willms, 2009). This gap continues to increase over time, resulting in the increased risk of low SES children to perpetuate the cycle of poverty by dropping out of school or failing to attend a postsecondary institution (Caro, McDonald, and Willms, 2009; DeNavas-Walt, Proctor, and Smith, 2012; Ou and Reynolds, 2008). Little is known about the mechanisms that link urban poverty to low academic achievement. However, one model posits that executive functioning may bring about negative academic outcomes in children when adversely affected by their environment (Evans and Rosenbaum, 2008). The primary aim of this study was to test the hypothesis that executive functioning is a mediator in the relationship between poverty-related stress and academic achievement. Secondarily, measurement models used to test this hypothesis were examined and group differences were explored. Results of analyses conducted are summarized and discussed below.

Group Differences and Variable Correlations

Preliminary analyses were first conducted, in which group differences and correlations were examined. Results of analyses examining group differences revealed age differences in the areas of stress and executive functioning, as well as gender differences in the area of executive functioning. In terms of age differences, results indicated older adolescents (older than 15 years) reported experiencing more stress in the form of major life events and daily hassles (major life

events/daily hassles), than younger adolescents (younger than 15 years). In addition, older adolescents reported experiencing increased deficits in executive functioning skills (i.e. T1 shift, T1 emotional control, T1 monitoring, T1 working memory, T1 planning/organization, T1 task completion, T2 shift, T2 monitoring, T2 planning/organization, and T2 task completion). However, on skills-based laboratory measures of executive functioning, older adolescents performed better than younger adolescents on tasks of Time 1 and Time 2 attention abilities, as well as Time 2 shifting abilities. However on Time 1 inhibition, older adolescents performed worse than younger adolescents.

Overall results of age differences suggest that, with the exception of attention abilities and Time 2 shift abilities, executive skills are poorer for older adolescents. These results are inconsistent with the definition of executive functions as higher order processes associated with the frontal lobe. Executive functioning abilities have been found to develop slowly at 9 months and continue developing into individual's early 40's (Denckla, 2007). Brain imaging studies have demonstrated structural brain maturation during adolescence through the process of myelination in the frontal cortex. Through this continued myelination of the frontal cortex into adolescence, transmission speed of neural information in this area continues to increase (Blakemore and Choudhury, 2006). In accordance with this biological explanation of the development of executive functioning processes, skills are hypothesized to improve as children get older. This hypothesis was supported by a recently published longitudinal study examining maturation of executive functioning processes during adolescence. In this study, children were tested at the age of 11 and again at the age of 19. Results demonstrated improvement of attentional control, processing speed, and cognitive flexibility over time (Bolema, Harakeh, Ormel, Hartman, Vollebergh, et.al. 2014).

The contradicting results of age differences in this study fit with those of prior research findings that executive functioning skills have an unclear developmental profile. Specifically, it is believed that executive processes may not develop linearly, and instead develop in spurts (Anderson, 2002). This hypothesis suggests that older and younger adolescence may have the same executive capacities for certain skills at certain time periods. Due to the possible influence of increased stress that comes with older adolescence (i.e. high school, relationships, family conflict), they may be experiencing more difficulties in executive functioning. This would be consistent with increased stress as reported by older adolescents when compared to younger adolescents in the current study.

In terms of gender differences, females reported experiencing greater difficulty in the executive functioning areas of T1 working memory, T1 shift, T1 and T2 emotional control, and T2 organization of materials. In addition, females performed worse on tasks measuring shifting abilities at Time 2 on skills-based measures of executive functioning. These findings suggest that female adolescents have greater difficulty on certain executive skills when compared to males. Specifically, it appears that females have greater difficulty with emotional control and shifting their attention to another task when compared to their male counterparts. While findings of gender differences in this study indicate that females having greater weakness on executive tasks, results from prior literature are mixed. Some prior studies reveal no gender differences in the development of executive functions and posit that females and males develop executive skills at the same rate (Anderson, 2002). However, some researchers have found gender differences for specific executive functioning skills.

For example, females have been shown to outperform their male counterparts in verbal fluency, information processing, and spatial organization, while males have been found to

outperform females in tasks of spatial reasoning and working memory (Anderson, 2002). One study examining gender differences in a representative sample of 5- 17 year olds found that females outperformed males in the areas of planning and attention (Naglieri and Rojahn, 2001). Similarly, the study by Boelema and colleagues, mentioned above, found gender differences in improvement of certain executive skills overtime. Specifically, working memory, inhibition, and sustained attention were found to be worse in males during early adolescence. However, during late adolescence males improved more in these areas than females. The same study, found that girls performed worse in the areas of processing speed and shift in early adolescence, however they demonstrated equal to greater improvement in later adolescence (Boelema, et.al., 2014). Unlike the study by Boelema and colleagues, the current study did not find consistency in gender differences at different time points. However results lend support to the notion of strengths in specific executive skills based on gender.

Results of correlation analyses revealed expected correlations between Time 1 and Time 2 executive functioning skills. Expected negative correlations were also found among all measures of executive functioning and major life events/daily hassles. Also significant, were the negative correlations between Time 2 GPA and all Time 2 executive functioning skills (with the exception of emotional control). These findings are consistent with the literature, which indicates that aspects of executive functioning are associated with stress and GPA (Fishbein et.al; Jensen, 2009). However, the variables of median family income and exposure to violence were not correlated with major life events/daily hassles, measures of Time 1 or Time 2 executive functioning, nor Time 1 or Time 2 GPA. Results of these correlation analyses are inconsistent with previous literature that links low socioeconomic status to increased difficulties with interpersonal stress and conflict, academic achievement, and the executive skills of working

memory, inhibition, and chronic flexibility (Collins et.al., 2010; Lambert, Bradshaw, Cammack, and Ialongo, 2011; Blair et al., 2011, Farah et al., 2011; Caro, McDonald, and Williams, 2009).

The lack of correlation between exposure to violence and grade point average is also inconsistent with a previous study which found exposure to violence to be associated with decreased grades, IQ, reading ability, and math and reading standardized assessment scores. (Delaney-Black et.al, 2002; Milam, Furr-Holden and Leaf, 2010). These inconsistencies with previous studies may be due to issues related to sample measurement methods of income and exposure to violence.

Measurement of income and exposure to violence. The current study used 2012 United States census data as a measure of income, and neighborhood violent crime incidents as a measure of exposure to violence at Time 1. The use of income gathered through census data was beneficial as an objective measure of socioeconomic status in lieu of parent report. In addition, census data and neighborhood data on exposure to violence served as an objective measure of the environmental stress experienced by participants. However as a result of using census and neighborhood data as measures, there was a mismatch in the level that indicator, mediator, and outcomes variables were assessed. This is because executive functioning and GPA were obtained through either participant report or individually reported scores. Therefore, the estimate obtained by using the neighborhood level measurements of income and exposure to violence may be more or less than experienced by specific participants. The potential inaccuracy of these estimations, along with the mismatch in assessment of each variable, may have contributed to the lack of correlation found between income/exposure to violence and executive functioning deficits/grade point average. Inaccuracies and the mismatch of assessment, may have also led to the negative correlations found between the number of violent crimes and income in this sample. These negative correlations are inconsistent with previous research demonstrating that living in urban

poverty disproportionality exposes children and their families to high crimes rates and neighborhood violence (Collins et al., 2010; Sznitman, Reisel, and Romer, 2011).

Poverty-Related Stress and Executive Functioning

Prior to conducting mediation analysis, measurement models were tested to examine the model fit for the latent variables of poverty-related stress and executive functioning deficits. Hypothesis I predicted adequate model fit for the latent variable of poverty-related stress. In this model, the latent variable of poverty-related stress is composed of the observed variables of median family income, number of violent crimes, and major life events/daily hassles. Hypothesis I was not supported as the model was unable to be interpreted due to being “underidentified”. Modification of the model by adding constraints did not solve this problem. The result of this analysis is consistent with correlation analyses, which found the variables of median income and violent crimes to be uncorrelated with that of major life events and daily hassles. However, this is inconsistent with prior research connecting socio-economic status to major life events and daily hassles experienced by urban youth (Collins et. al., 2010; Lambert, Bradshaw, Cammack, and Ialongo, 2011). Findings are also inconsistent with a past study which correlated census neighborhood variables with the UALES (major life events/daily hassles), and found economic factors (i.e. unemployment, childhood poverty, welfare receipt) to be significantly correlated with family/community stress (Allison, Burton, Marshall, Perez-Febles, Yarrington, et.al., 1999). Failure of correlations between median income, violent crimes, and major life events/daily hassles, may indicate that income and exposure to violence are more distal predictors of the stress. Specifically, other factors may influence the perception of low income and/or violent crimes as stressors for youth, such as perception of control, coping strategies, and social support (Hickle and Anthony, 2012).

Hypothesis II predicted adequate model fit for the latent variable of executive functioning deficits. In this model, the latent variable is composed of the observed subscales of inhibition, emotional control, working memory, shift, planning/organization, organization of materials, and task completion. Adequate model fit indicated support for Hypothesis II. This is consistent with confirmatory factor analysis performed by Gioia and colleagues (2000), which examined eight executive processes. This model is also consistent with the preliminary analyses of associations both among executive functioning variables at Time 1 and Time 2, as well as between Time 1 and Time 2 executive functioning variables. This indicates measuring executive functioning processes through contextual-based self-report is adequate for a sample of predominately minority, urban youth with diverse socioeconomic backgrounds. From an ecological validity perspective, qualitative and behavioral reports of executive processes may more accurately capture skills or difficulties experienced by youth in their everyday environment. This is because skills-based laboratory measures of executive functioning often require quiet, structured environments which do not reflect those environments in which adolescents function on a day-to-day basis (Anderson 2002). This was further supported by the results examining Research Question I. Research Question I explored a comparison model of executive functioning using skill-based laboratory measures. An attempt to analyze this model failed due to being underidentified. This implies that lab-based measures are less of an adequate fit with the sample than the contextual-based measured of the BRIEF. However, failure of this model may have also been likely due to the limited amount of laboratory based tasks, as there were only three tasks that contained data for participants at both Time 1 and Time 2. In addition, the N for the three lab-based tasks was likely too small to produce results of model fit with SEM, which in general

required at least 200 participants. Specifically the number of data points for Time 2 ranged from $N = 120$ to $N = 175$ across the three tasks.

Stress and Executive Functioning

Given the failure of Hypothesis I to support a measurement model for poverty-related stress, a post-hoc analysis was conducted to test Hypothesis III-A. In this post-hoc analysis, stress at Time 1 was measured with the variable major life events/daily hassles, instead of the constructed poverty-related stress latent variable. Hypothesis III-A was supported as major life events/daily hassles at Time 1 had a significant direct effect on Time 2 executive functioning, while controlling for Time 1 executive functioning. This finding is consistent with previous studies that find executive processes to be impacted by environments where youth are exposed to multiple stressors, chaos, and/or lack of structure. (Jesen, 2009; Blair et.al. 2001). This result indicates that the major life events and daily hassles experienced by urban adolescents have a direct effect on executive difficulties over time. In addition, this finding adds to literature, which has primarily focused on the impact of poverty, trauma, parent characteristics, and family environment on executive functioning (Sarsour et al., 2010; Porter and Leach, 2010; Shroeder and Kelly, 2009). Specifically, it gives support to the relationship between chronic and episodic stressors and executive functioning processes. Given that adolescents are likely to experience increased stress overtime due to increase academic demands, social stressors, and expectation for increased independence; this finding also has implications for preventative curriculums in which executive skills are taught and strengthened in the middle or high school settings (Rose and Rose, 2007).

Executive Functioning and Academic Achievement

Although the measurement model for the executive functioning latent variable fit with the current sample of data, support was not found for related Hypothesis III-B. This hypothesis suggests that Time 1 executive functioning would be associated with Time 2 GPA while controlling for GPA at Time 1. Results found adequate to good model fit with the data, however Time 1 executive functioning did not have a significant direct effect on Time 2 GPA. This finding is inconsistent with previous studies reviewed which found links between executive functioning skills and achievement in youth (Best, Miller, and Naglieri, 2011; Lutzman et al., 2010; Carlson and Wang, 2007).

Inconsistencies with these findings may be due to differences in the ways in which achievement has been assessed. Many studies have measured achievement through standardized achievement measures (i.e. Woodcock Johnson tests of Achievement, Wechsler Individual Achievement Test) (Best, Millier, and Naglieri, 2011), school-based standardized tests (Lutzman, Elkovitch, Young, and Clark, 2010), or tests of specific abilities (i.e. reading and math scores) (Mazzocco and Kover, 2007). This is contrasted with this study, which relied solely on GPA in various academic subjects. Possible difficulties with finding significant associations between executive functioning and GPA may be due to the idiosyncratic nature of GPA as a teacher dependent variable. It may be a poor indicator of academic functioning as some teachers may include items such as homework, extra credit, or class participation, which could have an effect on GPA separate from a student's true academic abilities. Lack of significant associations may also be due to the smaller number of participants with grade point average included at Time 2. Although maximum likelihood estimation uses every data point, the total amount of data points for GPA at Time 2 was 86. This likely proved to be an inadequate N for structural equation model analyses, which generally requires at least an N of 200. (Kline, 2005; Cole and Maxwell,

2003).

Conceptually, however results could also indicate that only certain executive functioning deficits are related to academic achievement in the sample. Most studies looking at executive functioning and achievement focused on specific executive skills. For example, Mazzocco and Kover (2007) examined only response inhibition and cognitive flexibility/shifting when looking at achievement in 6-11 year old children. Similarly, one study examining achievement in a large 5-17 year old sample examined the executive skills of planning, monitoring, and task completion (Best, Miller, and Naglieri, 2011); while another study examined the effects of problem solving and emotional control on achievement (Brocka, Rimm-Kauffman, Nathanson, and Grimm, 2009). This is in contrast to the current study, which tested a composite of day-to-day executive skills and laboratory measures. However, given that studies have not been reproduced to consistently link a specific executive functioning skill to achievement, more research needs to be done in this area.

Executive Functioning as a Mediator

Hypothesis III-C predicted poor model fit and support could not be found for executive functioning as a partial mediator in the relationship between Time 1 stress and Time 2 grade point average. One possible reason mediation was not found in the relationship between stress and executive functioning, is the possible role of psychopathology within this relationship. First, extensive literature has shown that poverty and poverty-related stressors can threaten psychological health and have been linked to internalizing and externalizing mental health disorders (Grant et.al., 2003, Conger, Wallace, Sun, Simons, McLoyd, and Brody, 2002; Grant, McCormick, Poindexter, Simpkins, Janda, et al., 2005; Hammack, Robinson, Crawford, and Li,

2004; McLoyd, 1998; Ritscher, Warner, Johnson, and Dohrenwend, 2001; Wadsworth and Berger, 2006). Further, many studies have found support for a relationship between psychological distress and executive functioning processes (Drabick, Bubier, Chen, Price, and Lanza, 2011; Walter, Palmieri, and Gunstad, 2010; Aupperle, Melrose, Stein, and Paulus, 2012; DePrince, Weinzierl, and Combs, 2009).

For example, Polak and colleagues (2012) conducted a meta-analysis examining the role of executive functioning in post-traumatic stress disorder. It was found that across studies adults with posttraumatic stress disorder displayed decreased performance on tasks requiring cognitive shift, working memory, attention, and inhibition skills (Polak, Witteveen, Reitsman, and Olf, 2012). Another study examined executive functioning as a moderator in the relationship between collateral report of oppositional defiant symptoms and subsequent psychological symptoms in a sample of urban school-age children. Results of the study revealed that higher levels of executive abilities (i.e. working memory, inhibition, planning, attention, and cognitive shift) moderated the relationship between Time 1 parent-report of ODD symptoms and Time 2 ODD symptoms. Similarly, higher executive functioning skills moderated the relationship between teacher-reported Time 1 ODD symptoms and Time 2 symptoms of Conduct Disorder and Major Depressive Disorder. While the effects of psychopathology in the relationship between poverty and executive functioning were not the focus of the current study, results of prior studies indicate that their presence in the overall theoretical model may have accounted for additional mechanisms in which stress impacts academic achievement.

Limitations

Limitations of the current study include methodological issues concerning aspects of study design, measurement of predictor variables, sample size for outcome variables, and aspects of attrition affecting generalizability. A design limitation of the current study was the absence of a three-wave longitudinal design. This prevented the examination of full mediation of the relationships between stress, executive functioning deficits, and academic achievement. In addition, measures of executive functioning were limited to self-report of the BRIEF and limited skills-based laboratory measures. Although subscales of the BRIEF were an adequate fit for the data, a battery of measures and/or parent and school report are recommended in order to accurately assess executive functioning (Anderson, 2002).

Another limitation of the current study was the small sample size of the outcome measure, grade point average. Due to the inability to get permission for the release of all participant report card data, the power of statistical analysis needed for SEM was low. In general, SEM analyses require at least 200 participants. However results indicated that there were only 86 data points for the outcome variable of grade point average. This small sample size likely affected the significance of path estimates linking executive functioning to academic achievement. Finally, this study is limited in its generalizability given that the sample was over-represented by participants in 11th grade versus other grade levels. Therefore results are likely more applicable to older adolescents and may reflect relationships that pertain to participants in that particular grade level. These limitations, especially those concerning study design may have impacted the ability to find model fit for the variable of poverty related stress, as well as the ability to find significance of executive functioning as a mediator in the relationship between stress and grade point average.

Future Directions

Given that findings did not support the theoretical model; as well as problems with measurement and attrition, future studies should look to assess the theoretical model with a larger sample size. Future research should also look to test the theoretical model with at least a three-wave longitudinal design to test full mediation of the relationships between poverty-related stress, executive functioning, and academic achievement. In addition, given the significant effect of major life events and daily hassles on executive functioning, future research should focus on specifying which types of stress are most linked to executive functioning skills. For example, future studies may wish to compare a model in which executive deficits are primarily related to community and family stressors, against a model in which executive deficits are more affected by peer-related stress factors. Finally, although this study did not focus on the relationship gender has on executive processes, results of group preliminary analysis lent support to findings of gender differences for specific executive skills. Given the mix of conclusions about gender differences in prior research studies, future research should look to replicate these findings in a larger representative sample.

Conclusion

The current study explored executive functioning as a mediator in the relationship between poverty related stress and academic achievement. Based on Bronfenbrenner's Theory of ecological development and the concept of proximal processes, it was theorized that proximal processes lead to executive dysfunction in adolescents exposed to chronic poverty related stress. It was therefore hypothesized that executive functioning would serve as a mediator in the relationship between poverty related stress and academic achievement. Given the multiple indicators of poverty related stress and executive functioning introduced in this study, hypotheses regarding the measurement models of these constructs were also tested. While the

measurement model of poverty related stress was not supported; support was found for the measurement model examining the latent variable of executive functioning. However, results did not demonstrate support for the main hypothesis in which executive functioning would serve as a mediator in the relationship between poverty related stress and achievement. Although evidence was not found for the studies mediation hypothesis, support was found in the relationship between chronic and episodic stressors and executive functioning processes. Given that adolescents are likely to experience increased stress overtime, this finding has implication for the prevention of executive deficits and low achievement. These can take the form of curriculums in which executive skills are taught and strengthened in the middle or high school settings (Rose and Rose, 2007). There is also support for the role of interventions in clinical settings, which include strengthening of executive skills for adolescents experiencing stress. These interventions may also improve self-efficacy and esteem in the school context, as well as serve to increase emotional control abilities and attention in this population.

References

- Allison, K.W., Burton, L., Marshall, S., Perez-Febles, A., Yarrington, J., Kirsh, L.B., and Merriwether-DeVries, C. (1999). Life experiences among urban adolescents: Examining the role of context. *Child Development*, 70(4), 1017. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=tfhand&AN=2163802&site=ehost-live&scope=site>
- American Psychological Association (2014). Children, youth, and families, and socioeconomic status. Retrieved from <http://www.apa.org/pi/ses/resources/publications/factsheet-cyf.aspx>
- Anderson, P. (2002). Assessment and development of executive function (EF) during childhood. *Child Neuropsychology*, 8, 71-82
- Arbuckle, J.L. (2010). IBM SPSS Amos 19 users guide. Amos Development Corporation. Crawfordsville, FL.
- Aupperle, R.L., Melrose, A.J., Stein, M.B., and Paulus, M.P. (2012). Executive function and PTSD: Disengaging from trauma. *Neuropharmacology*, 63, 686-694
- Barkley, R. A. (1990). Attention deficit hyperactivity disorder: A handbook for diagnosis and treatment. New York: Guilford Press.
- Bernier, A., Carlson, S. M., and Whipple, N. (2010). From external regulation to self-regulation: Early parenting precursors of young children's executive functioning. *Child Development*, 81(1), 326-339.

- Best, J. R., Miller, P. H., and Naglieri, J. A. (2011). Relations between executive function and academic achievement from ages 5 to 17 in a large, representative national sample. *Learning and Individual Differences, 21*(4), 327-336. doi: 10.1016/j.lindif.2011.01.007
- Bierderman, J., Monuteaux, M. C., Doyle, A. E., Seidman, L. J., Wilens, T. E., Fererro, F., and et al. (2004). Impact of executive function deficits and ADHD on academic outcomes in children. *Journal of Consulting and Clinical Psychology, 72*, 757-766.
- Blair, C., and Razza, R. P. (2007). Relating effortful control, executive function, and false belief understanding to emerging math and literacy ability in kindergarten. *Child Development, 78*, 647-663.
- Blair, C., Granger, D. A., Willoughby, M., Mills-Koonce, R., Cox, M., Greenberg, M. T., . . . The FLP Investigators. (2011). Salivary cortisol mediates effects of poverty and parenting on executive functions in early childhood. *Child Development, 82*(6), 1970-1984. doi: 10.1111/j.1467-8624.2011.01643.x
- Blakemore, S.J. and Choudhury, S. (2006). Development of the adolescent brain: Implications for executive function and social cognition. *Journal of Child Psychology and Psychiatry, 47*, 296-312
- Blankenship, A. B. (1938). Memory span: A review of the literature. *Psychological Bulletin, 35*(1), 1-25. doi: 10.1037/h0061086

Bolema, S. R., Harakeh, Z., Ormel, J., Hartman, C.A. Vollebergh, W.A., van Zandvoort, M.J.

(2014). Executive function shows differential maturation from early to late adolescence:

Longitudinal findings from a TRAILS study. *Neuropsychology*, 28, 177-187

Brocka, L. L., Rimm-Kaufman, S. E., Nathanson, L., and Grimm, K. J. (2009). The contributions

of 'hot' and 'cool' executive function to children's academic achievement, learning-related

behaviors, and engagement in kindergarten. *Early Childhood Research Quarterly*, 24(3),

337-349. doi: 10.1016/j.ecresq.2009.06.001

Bronfenbrenner, U., and Evans, G. W. (2000). Developmental science in the 21st century:

Emerging questions, theoretical models, research designs and empirical findings. *Social*

Development, 9(1), 115-125. doi: 10.1111/1467-9507.00114

Bronfenbrenner, U., and Morris, P. A. (1998). In Damon W., Lerner R. M. (Eds.), *The ecology of developmental processes*. Hoboken, NJ, US: John Wiley and Sons Inc, Hoboken, NJ.

Retrieved from <http://search.proquest.com/docview/620676618?accountid=14552>

Brown, E. D., and Low, C. M. (2008). Chaotic living conditions and sleep problems associated

with children's responses to academic challenge. *Journal of Family Psychology*, 22(6), 920-

923. doi: 10.1037/a0013652

Byrne, B.M. (2005). Structural equation modeling with Amos, EQS, and LISERAL:

Comparative approaches to testing for the factorial validity of a measurement instrument.

International Journal of Testing, 1 55-86.

- Carlson, S. M., and Wang, T. S. (2007). Inhibitory control and emotional regulation in preschool children. *Cognitive Development*, 22, 489-510.
- Caro, D. H., McDonald, J. T., and Willms, J. D. (2009). Socio-economic status and academic achievement trajectories from childhood to adolescence. *Canadian Journal of Education*, 32(3), 558-590.
- Chen, G., and Weikart, L. A. (2008). Student background, school climate, school disorder, and student achievement: An empirical study of new york city's middle schools. *Journal of School Violence*, 7(4), 3-20. doi: 10.1080/15388220801973813
- Cole, D. A., and Maxwell, S. E. (2003). Testing mediational models with longitudinal data: Questions and tips in the use of structural equation modeling. *Journal of Abnormal Psychology*, 112(4), 558-577. doi: 10.1037/0021-843X.112.4.558
- Collins, K., Connors, K., Donohue, A., Gardner, S., Goldblatt, E., Hayward, A., . . . Thompson, E. (2010). *Understanding the impact of trauma and urban poverty on family systems: Risks, resilience, and interventions*. Baltimore, MD: Family Informed Trauma Treatment Center.
- Conger, R. D., Wallace, L. E., Sun, Y., Simons, R. L., McLoyd, V. C., and Brody, G. H. (2002). Economic pressure in african american families: A replication and extension of the family stress model. *Developmental Psychology*, 38(2), 179-193. doi: 10.1037/0012-1649.38.2.179
- Cooper-Kahn, J., and Dietzel, L. (2008). *Late, lost, and unprepared: A parents' guide to helping children with executive functioning*. Bethesda, MD: Woodbine House.

- Delaney-Black, V., Convington, C., Ondersma, S. J., Nordstrom-Klee, B. A., Templin, T., Ager, J., . . . Sokol, R. J. (2002). Violence exposure, trauma, and IQ, and/or reading deficits among urban children. *Archives of Pediatrics and Adolescent Medicine, 15*, 280-285.
- DeNavas-Walt, C., Proctor, B. D., and Smith, J. C. (2012). *Income, poverty, and health insurance coverage in the united states: 2011: Current population reports*. Washington, DC: United States Census Bureau.
- Denckla, M.B. (2007) Executive functioning: Binding together the definitions of Attention Deficit/Hyperactivity Disorder and Learning Disabilities. In Lynn Meltzer (Ed.). *Executive function in education: From theory to practice*. New York, NY: The Guilford Press.
- DePrince, A.P., Weinzierl, K. M., and Combs, M.D. (2009). Executive function performance and trauma exposure in a community sample of children. *Child Abuse and Neglect, 33*, 353-361
- Drabick, A.G., Bubier, J., Chen, D., Price, J., and Lanza, H.I. (2011). Source-specific Oppositional Defiant Disorder among inner-city children: Prospective prediction and moderation. *Journal of Clinical Child and Adolescent Psychology, 40*, 23-35
- Egeland, J., and Fallmyr, Ø. (2010). Confirmatory factor analysis of the behavior rating inventory of executive function (BRIEF): Support for a distinction between emotional and behavioral regulation. *Child Neuropsychology, 16*(4), 326-337. doi: 10.1080/09297041003601462
- Evans, G. W., and Rosenbaum, J. (2008). Self-regulation and the income-achievement gap. *Early Childhood Research Quarterly, 23*(4), 504-514. doi: 10.1016/j.ecresq.2008.07.002

Farah, M. J., Shera, D. M., Savage, J. H., Betancourt, L., Giannetta, J. M., Brodsky, N. L., and et al. (2006). Child poverty: Specific associations with neurocognitive development. *Brain Research, 1110*, 166-174.

Fishbein, D., Warner, T., Krebs, C., Trevarthen, N., Flannery, B., and Hammond, J. (2009). Differential relationships between personal and community stressors and children's neurocognitive functioning. *Child Maltreatment, 14*(4), 299-315. doi: 10.1177/1077559508326355

Gioia, G. A., Isquith, P. K., Guy, S. C., and Kentworthy, L. (2000). *Behavior rating inventory of executive function*. Lutz, FL: Psychological Assessment Resources.

Grant, K. E., Compas, B. E., Stuhlmacher, A. F., Thurm, A. E., McMahon, S. D., and Halpert, J. A. (2003). Stressors and child and adolescent psychopathology: Moving from markers to mechanisms of risk. *Psychological Bulletin, 129*(3), 447-466. doi: 10.1037/0033-2909.129.3.447

Grant, K. E., McCormick, A., Poindexter, L., Simpkins, T., Janda, C. M., Thomas, K. J., et al. (2005). Exposure to violence and parenting as mediators between poverty and psychological symptoms in urban African American adolescents. *Journal of Adolescence, 28*, 507-521.

Grant, K., Poindexter, L., Davis, T., Cho, M.H., McCormick, A., and Smith, K. (2000). Economic

stress and psychological distress among urban African American adolescents. *Journal of Prevention and Intervention in the Community*, 20, 25-36

Hammack, P. L., Robinson, W. L., Crawford, I., and Li, S. T. (2004). Poverty and depressed mood among urban African-American adolescents: A family stress perspective. *Journal of Child and Family Studies*, 13, 309-323.

Hickle, K. and Anthony, E.K. (2012). Transactional stress and anxiety control beliefs among low-income early adolescents. *Children and Youth Services Review*, 35, 353-357

Hu, L. and Bentler, P.M. (1999). Cut-off criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, 6, 1-55.

Irvin, M. J., Meece, J. L., Byun, S., Farmer, T. W., and Hutchins, B. C. (2011). Relationship of school context to rural youth's educational achievement and aspirations. *Journal of Youth and Adolescence*, 40(9), 1225-1242. doi: 10.1007/s10964-011-9628-8

Jensen, E. (2009). *Teaching with poverty in mind: What being poor does to kid's brains and what schools can do about it*. Alexandria, Virginia: ASCD.

Kinsella, G., Prior, M., Sawyer, M., Ong, B., Murtagh, D., Eisenmajer, R., and et al. (1997). Predictors and indicators of academic outcome in children 2 years following traumatic brain injury. *Journal of International Neuropsychological Society*, 3, 608-616.

Kline, R.B. (2005). *Principles and practice of structural equation modeling*. Second Edition. The Guilford Press, New York, NY.

- Lambert, S. F., Bradshaw, C. P., Cammack, N. L., and Ialongo, N. S. (2011). Examining the developmental process of risk for exposure to community violence among urban youth. *Journal of Prevention and Intervention in the Community, 39*(2), 98-113.
- Larrabee, G. J. (1995). Construct validity of various verbal and visual memory tests. *Journal of Clinical and Experimental Neuropsychology, 17*, 536.
- Latzman, R. D., Elkovitch, N., Young, J., and Clark, L. A. (2010). The contribution of executive functioning to academic achievement among male adolescents. *Journal of Clinical and Experimental Neuropsychology, 32*(5), 455-462. doi: 10.1080/13803390903164363
- Malecki, C. K., and Demaray, M. K. (2006). Social support as a buffer in the relationship between socioeconomic status and academic performance. *School Psychology Quarterly, 21*(4), 375-395. doi: 10.1037/h0084129
- Mazzocco, M. M., and Kover, S. T. (2007). A longitudinal assessment of executive function skills and their association with math performance. *Child Neuropsychology, 13*(1), 18-45. doi: 10.1080/09297040600611346
- McLoyd, V. C. (1998). Socioeconomic disadvantage and child development. *American Psychologist, 53*, 185-204.
- Meiran, N. (1996). Reconfiguration of processing mode prior to task performance. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 22*(6), 1423-1442. doi: 10.1037/0278-7393.22.6.1423

- Meltzer, L. (Ed.). (2007). *Executive function in education: From theory to practice*. New York, NY: The Guilford Press.
- Milam, A. J., Furr-Holden, C. D. M., and Leaf, P. J. (2010). Perceived school and neighborhood safety, neighborhood violence and academic achievement in urban school children. *The Urban Review*, 42(5), 458-467. doi: 10.1007/s11256-010-0165-7
- Milne, A., and Plourde, L. A. (2006). Factors of a low-SES household: What aids academic achievement? *Journal of Instructional Psychology*, 33(3), 183-193.
- Moon, S. S., Hegar, R. L., and Page, J. (2009). TANF status, ethnicity, and early school success. *Children and Youth Services Review*, 31(8), 854-863. doi: 10.1016/j.childyouth.2009.03.008
- Moran, S., and Gardner, H. (2007). "Hill, skill, and will" : Executive function from a multiple-intelligences perspective. In L. Meltzer (Ed.), *Executive function in education: From theory to practice* (pp. 19-38). New York, NY: The Guilford Press.
- Naglieri, J. A., and Rojahn, J. (2001). Gender differences in Planning, Attention, Simultaneous, and Successive (PASS) cognitive processes and achievement. *Journal of Educational Psychology*, 93, 430–437.
- Noble, K. G., Norman, M. F., and Farah, M. J. (2005). Neurocognitive correlates of socioeconomic status in kindergarten children. *Developmental Science*, 8, 74-87.
- Obradović, J., Long, J. D., Cutuli, J. J., Chan, C., Hinz, E., Heistad, D., and Masten, A. S. (2009). Academic achievement of homeless and highly mobile children in a urban school

- district: Longitudinal evidence on risk, growth, and resilience. *Development and Psychopathology*, 21(2), 493-518. doi: 10.1017/S0954579409000273
- Ou, S., and Reynolds, A. J. (2008). Predictors of educational attainment in the Chicago longitudinal study. *School Psychology Quarterly*, 23(2), 199-229. doi: 10.1037/1045-3830.23.2.199
- Perkins, S., and Graham-Bermann, S. (2012). Violence exposure and the development of school-related functioning: Mental health, neurocognition, and learning. *Aggression and Violent Behavior*, 17(1), 89-98. doi: 10.1016/j.avb.2011.10.001
- Polak, A.R., Witteveen, A.B., Reitsma, J.B., Olf, M. (2012). The role of executive function in posttraumatic stress disorder: A systematic review. *Journal of Affective Disorders* (2012), doi:[10.1016/j.jad.2012.01.001](https://doi.org/10.1016/j.jad.2012.01.001)
- Porter, H. and Leach, J. (2010). Executive dysfunction in a survival environment. *Applied Cognitive Psychology*, 24, 41-66
- Purcell-Gates, V., McIntyre, E., and Freppon, P. A. (1995). Learning written storybook language in school: A comparison of low-SES children in skills-based and whole language classrooms. *American Educational Research Journal*, 32, 659-685.
- Raver, C. C., Blair, C., Willoughby, M., and The Family Life Project Key Investigators. (2012). Poverty as a predictor of 4-year-olds' executive function: New perspectives on models of differential susceptibility. *Developmental Psychology*, doi: 10.1037/a0028343
- Ritsher, J. E. B., Warner, V., Johnson, J. G., and Dohrenwend, B. P. (2001). Inter

generational longitudinal study of social class and depression: A test of social causation and social selection models. *British Journal of Psychiatry*, 178, s84-s90.

Rose, D., and Rose, K. (2007). Deficits in executive functioning processes: A curriculum-based intervention. In Lynn Meltzer (Ed.). *Executive function in education: From theory to practice*. New York, NY: The Guilford Press.

Rouse, H. L., and Fantuzzo, J. W. (2009). Multiple risks and educational well being: A population-based investigation of threats to early school success. *Early Childhood Research Quarterly*, 24(1), 1-14. doi: 10.1016/j.ecresq.2008.12.001

Sarsour, K., Sheridan, M., Jutte, D., Nuru-Jeter, A., Hinshaw, S., and Boyce, W. T. (2011). Family socioeconomic status and child executive functions: The roles of language, home environment, and single parenthood. *Journal of the International Neuropsychological Society*, 17(1), 120-132. doi: 10.1017/S1355617710001335

Schroeder, V., & Kelley, M. L. (2009). Family environment and parent-child relationships as related to executive functioning in children. *Early Child Development and Care*, 18, 227-235

Sergeant, J. A., Geurts, H., and Oosterlaan, J. (2002). How specific is a deficit of executive functioning for attention-deficit/hyperactivity disorder? *Behavioural Brain Research. Special Issue: Neurobehavioural Mechanisms in ADHD*, 130(1-2), 3-28. doi: 10.1016/S0166-4328(01)00430-2

Simmonds, D. J., Pekar, J. J., and Mostofsky, S. H. (2008). Meta-analysis of go/no-go tasks demonstrating that fMRI activation associated with response inhibition is task-dependent.

Neuropsychologia, 46(1), 224-232. doi: 10.1016/j.neuropsychologia.2007.07.015

Simonds, J., Kieras, J. E., Rueda, M. R., and Rothbart, M. K. (2007). Effortful control, executive attention, and emotional regulation in 7-10 year old children. *Cognitive Development*, 22, 474-488.

Sznitman, S. R., Reisel, L., and Romer, D. (2011). The neglected role of adolescent emotional well-being in national educational achievement: Bridging the gap between education and mental health policies. *Journal of Adolescent Health*, 48(2), 135-142. doi:

10.1016/j.jadohealth.2010.06.013

Thompson, T., and Massat, C. R. (2005). Experiences of violence, post-traumatic stress, academic achievement and behavior problems of urban african-american children. *Child and Adolescent Social Work Journal*, 22(5-6), 367-393. doi: 10.1007/s10560-005-0018-5

Wadsworth, M. E., and Berger, L. E. (2006). Adolescents coping with poverty-related family stress: Prospective predictors of coping and psychological symptoms. *Journal of Youth and Adolescence*, 35(1), 54-67. Retrieved from

<http://search.proquest.com.ezproxy2.lib.depaul.edu/docview/62031724?accountid=10477>

Walter, K.H., Palmieri, P.A., and Gunstad, J. (2010). More than symptom reduction: Changes in executive function over the course of PTSD treatment. *Journal of Traumatic Stress*, 23, 292-

295

- Wright, V. R., Thampi, K., and Chau, M. (2011). *Poor children by parents' nat ivity: What do we know?* (). Columbia University: National Center for Children in Poverty.
- Wilkinson, R. T., and Houghton, D. (1982). Field test of arousal: A portable reaction timer with data storage. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, 24(4), 487-493. doi: 10.1177/001872088202400409
- Wolniak, G. C., and Engberg, M. E. (2010). Academic achievement in the first year of college: Evidence of the pervasive effects of the high school context. *Research in Higher Education*, 51(5), 451-467. Retrieved from <http://dx.doi.org/10.1007/s11162-010-9165-4>
- Zera, D. A., and Lucian, D. G. (2001). Self-organization and learning disabilities: A theoretical perspective for the interpretation and understanding of dysfunction. *Learning Disability Quarterly*, 24(2), 107-118.